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INTRODUCTION

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA*

Thesaurus should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirachical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 566
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 572
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 575
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 577
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 590
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 592
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 599
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 603
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 606
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 608
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 611
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

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14 Instrumentation and Photography 629
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 637
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

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18 Materials, Nonmetallic 651
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19 Mathematics 656
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 659
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 662
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 666
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

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28 Propulsion Systems 681
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29 Space Radiation 683
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 684
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 693
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 698
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 702
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 706
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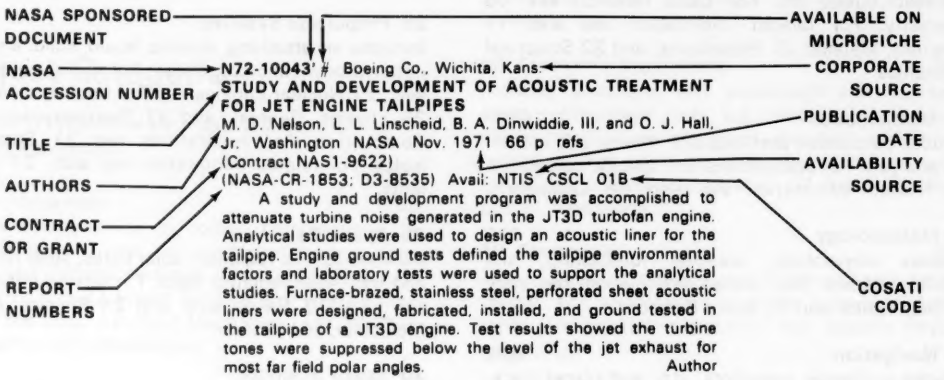
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N72-10043* # Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles.
Author

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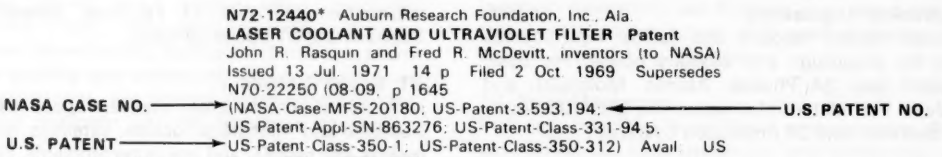
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U.S. PATENT CLASS NUMBERS
U.S. PATENT NO.
N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA) Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION

U.S. PATENT APPLICATION SERIAL NO.
N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
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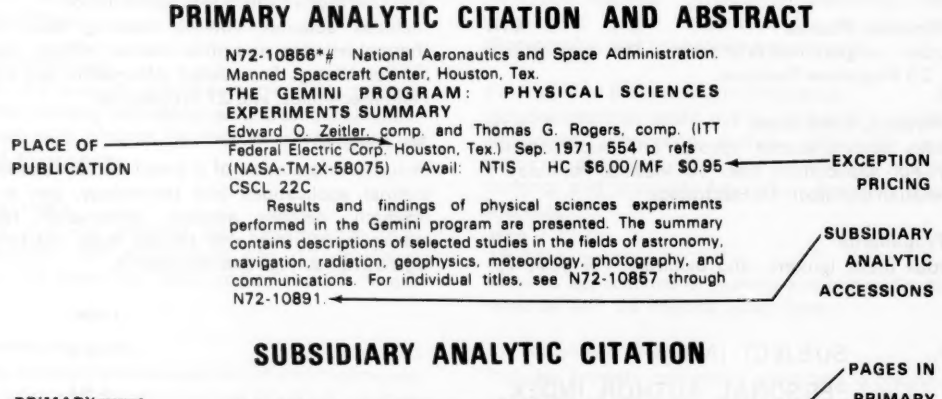
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Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

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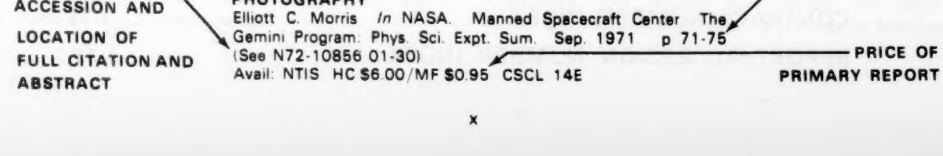
PRIMARY ANALYTIC ACCESSION AND LOCATION OF FULL CITATION AND ABSTRACT
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N72-10862*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris In NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

VOLUME 10 NUMBER 5 / MARCH 8, 1972

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-13976*# Chrysler Corp., Huntsville, Ala. Space Div.
RESULTS OF A STUDY OF MACH NUMBER AND REYNOLDS NUMBER EFFECTS ON THE CROSSFLOW DRAG CHARACTERISTICS OF OGIVE CYLINDERS AND OGIVE-CYLINDER-FRUSTUM-CYLINDERS AT ANGLES OF ATTACK TO 30 DEGREES
J. E. Foley 22 Oct. 1971 68 p refs
(Contract NAS8-21152; LTV Order P-451008-AER)
(NASA-CR-61365; TN-AP-71-527) Avail: NTIS CSCL 20D

An analysis was made to determine the effects of Mach number and Reynolds number on the local and total crossflow drag characteristics of ogive-cylinders and ogive-cylinder-frustum-cylinders at angles of the MSFC 14 in TWT and the LTV 4 ft HSWT, and pressure data obtained in the TWT, at Mach numbers 0.14, 0.8, 1.2, and 2.0, and a wide range of Reynolds numbers. Results indicate that the streamwise Reynolds number, VD/nusin alpha, is an important correlation parameter in the subcritical Reynolds number range at imcompressible speeds and that the crossflow Mach number correlates compressibility effects. Author

N72-13977*# Rochester Applied Science Associates, Inc., N.Y.
DEVELOPMENT AND APPLICATION OF A METHOD FOR PREDICTING ROTOR FREE WAKE POSITIONS AND RESULTING ROTOR BLADE AIR LOADS. VOLUME 2: PROGRAM LISTINGS
S. Gene Sadler Washington NASA Dec. 1971 149 p
(Contract NAS1-8448)
(NASA-CR-1912; Rept-69-11-Vol-2) Avail: NTIS CSCL 01A

Computer program listings are presented for two separate programs: the wake geometry 1 blade loads and response. These listings correspond to the calculations discussed previously. Author

N72-13978*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND TUNNEL STUDY OF SLOT SPOILERS FOR DIRECT LIFT CONTROL
Dominick Andrisani, II, Garl L. Gentry, Jr., and Joseph W. Stickle Washington Jan. 1972 42 p refs
(NASA-TN-D-6627; L-8014) Avail: NTIS CSCL 01A

An investigation was conducted in a 300-mph 7- by 10-foot tunnel to obtain data for a slot spoiler direct lift control system. Slot spoilers are believed to have advantages over flap-type direct lift control (DLC) systems because of the small amount of power required for actuation. These tests, run at a Reynolds number of 1,400,000 showed that up to 78 percent of the lift due to flap deflection could be spoiled by opening several spanwise slots within the flaps. For a given lift change the drag change was significantly less than that which would be obtained by a variable flap DLC system. A nozzle-shaped slot was the most effective of the slot shapes tested. Author

N72-13979# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
FLAT PLATE PAIRS AND OPEN CENTRE DISCS IN SUPERSONIC FLOW
R. D. Archer Jun. 1971 31 p refs
(IC-Aero-71-18) Avail: NTIS

Schlieren photographs of flat plate pairs and open center discs were taken at Mach numbers between 1.25 and 3.0, using a 12 inch square closed jet Mach 1.8 blowdown wind tunnel and an open jet variable speed tunnel. Four modes of flow patterns in this class of blunt body were distinguished. Drag measurements made at Mach 1.8 on 1 inch diameter open center discs showed a simple linear fall with hole size. Author

N72-13980# Centre National de la Recherche Scientifique, Meudon (France).
DELTA WINGS, WITH OR WITHOUT TRAILING EDGE FLAP, IN A RAREFIED HYPERSONIC GAS FLOW
Jean Allegre Apr. 1971 63 p refs In FRENCH; ENGLISH summary
(Rept-71-2) Avail: NTIS

The aerodynamic characteristics of delta wings located in a rarefied hypersonic gas flow at various angles of attack are presented. Trailing edge flap effects are recorded and associated separations are investigated. The flow is characterized by a Mach number of 8 and a free stream Reynolds number of 2200 per cm, simulating roughly a flight altitude of 60 km. Results are included for drag and lift coefficients at incidences up to 50, wall pressure data along the wing center-line, and external flow probing. Visualizations obtained by means of glow discharge and oil film deposit allpw definitions of incident shock such as separation and flap shocks locations. The tri-dimensional separation spreading is indicated for various wing incidences and flap configurations. Data are compared, when possible, with previous experimental results and available theoretical approaches in weak and strong interaction regimes. Author

N72-13981# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Gasdynamik.
AERODYNAMIC INVESTIGATIONS ON BODIES OF REVOLUTION IN THE TRANSONIC SPEED RANGE. PART 1: SYSTEMATIC THREE-COMPONENT MEASUREMENTS

K. Hartmann Dec. 1970 65 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-67; AVA-FB-7046) Avail: NTIS; ZLDI Munich: 16,70 DM

In order to investigate the aerodynamic problems in the transonic speed range on bodies of high fineness ratio such as would be used on missiles, systematic three-component measurements were conducted in a transonic wind tunnel on six different bodies of revolution. The bodies were tested at Mach numbers from Ma=0.5 to Ma=1.2 at angles of attack from alpha = -4 deg to alpha = 16 deg. ces and moments on one of the bodies were investigated at the Mach numbers Ma=0.9; 1.0 and 1.1. Author (ESRO)

N72-13982# United Aircraft Corp., East Hartford, Conn.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF HELICOPTER ROTOR HOVER PERFORMANCE AND WAKE GEOMETRY CHARACTERISTICS Final Report, Jul. - Oct. 1969
Anton J. Landgrebe Jun. 1971 232 p refs
(Contract DAAJ02-69-C-0056; DA Proj. 1F1-62203-A-139)
(AD-728835; UARL-K910828-31; USAAMRDL-TR-71-24)
Avail: NTIS CSCL 01/3

An analytical and experimental investigation was conducted to acquire systematic model rotor performance and wake geometry data and to evaluate the accuracy of various analytical methods in predicting the effects on performance of changes in helicopter rotor design and operating parameters. Both classical hover performance analyses and analytical methods recently developed at the United Aircraft Research Laboratories were evaluated. Of primary concern in the study was the assessment of assumptions in the analyses regarding the geometry of the rotor wake. Of particular interest was the prediction by the analysis of an instability of the tip vortex helix at moderate distances from the rotor which appeared to be substantiated by available experimental results. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-13983# Defense Documentation Center, Alexandria, Va.
HUMAN FACTORS IN DESIGN AND CONTROL OF AIRCRAFT A DDC bibliography, Jul. 1955 - Jul. 1970
Aug. 1971 236 p refs
(AD-729840; DDC-TAS-71-43) Avail: NTIS CSCL 01/3

The annotated bibliography contains references to reports which provide human engineering configurations dealing with location and arrangement of controls and displays in aircraft. It also includes pertinent information on the psychological and biomedical aspects of human performance in aviation training as well as in actual flight. A Corporate Author-Monitoring Agency and Subject Index are included. Author (GRA)

N72-13984*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
RIDE COMFORT CONTROL IN LARGE FLEXIBLE AIRCRAFT M.S. Thesis
Michael Edward Warren May 1971 123 p refs
(Grant NGR-22-009-548)
(NASA-CR-116775; TE-48) Avail: NTIS CSCL 01B

The problem of ameliorating the discomfort of passengers on a large air transport subject to flight disturbances is examined. The longitudinal dynamics of the aircraft, including effects of body flexing, are developed in terms of linear, constant coefficient differential equations in state variables. A cost functional, penalizing the rigid body displacements and flexure accelerations over the surface of the aircraft is formulated as a quadratic form. The resulting control problem, to minimize the cost subject to the state equation constraints, is of a class whose solutions are well known. The feedback gains for the optimal controller are calculated digitally, and the resulting autopilot is simulated on an analog computer and its performance evaluated. Author

N72-13985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY RESULTS ON TWO-SEGMENT NOISE ABATEMENT STUDIES
Dallas G. Denery, Kent Bourquin, and Fred J. Drinkwater, III 22 Sep. 1971 27 p refs
(NASA-TM-X-62098) Avail: NTIS CSCL 01B

The two-segment noise abatement approach procedure has been evaluated in an operational cockpit environment using operational equipment. The upper segment glide slope was determined by a three dimensional area navigation system and the lower segment glide slope was provided by the ILS glide slope beam. The flight director steering computer was modified to provide the pilot with continuous command information during the entire approach. A thirty-day flight test program was conducted at Stockton Metropolitan Airport, Stockton, California. Twenty-eight pilots representing the airlines, professional pilot associations, NASA, and the FAA participated in the flight evaluation. One hundred ninety two-segment approaches consisting of a six-degree upper glide slope and a 400 ft ILS intercept altitude were flown. Noise data and aircraft position data were measured on the ground during the approach studies. Although the data presented in this report are preliminary, the two-segment approach appears to be an operationally feasible way of reducing airport community noise. Author

N72-13986*# National Aeronautics and Space Administration, Washington, D.C.
EXPERIMENTAL STUDY ON THE GROUND EFFECT OF A MODEL HELICOPTER ROTOR IN HOVERING
Jiro Koo and Toichi Oka Dec. 1971 23 p refs Transl. into ENGLISH of Natl. Aerospace Lab., Tokyo, report NAL-TR-113
(NASA-TT-F-13938; NAL-TR-113) Avail: NTIS CSCL 01B

Aerodynamic characteristics of a model helicopter rotor hovering in the ground effect have been experimentally investigated. Measurements of the thrust, torque and induced velocity of the hovering rotor in the ground effect/and flow visualizations around the hovering rotor in the ground effect by the use of tuft. The qualitative results obtained are as follows: (1) when a hovering rotor in higher pitch angle gets near to the ground, there is a saturation in the thrust increase from the ground effect according to the blade stall, and (2) it appears from flow observations that the periodical fluctuation of interference flow between down-wash and up-wash may introduce the unsteady phenomena of a hovering helicopter in the ground effect. Author

N72-13987*# Scientific Translation Service, Santa Barbara, Calif.
METHOD OF MEASUREMENT AND ANALYSIS OF NOISE OF AN AIRCRAFT IN FLIGHT
S. Auzolle and J. Hay Washington NASA Dec. 1971 39 p Transl. into ENGLISH of "Methodes de Mesure et d'Analyse du Bruit des Avions en Vol" Paris, Soc. Natl. d'Etude et de Construc. de Moteurs d'Aviation, 1971 27 p Presented at the 10th Intern. Aeron. Congr. of AFITA, Paris, 1-3 Jun. 1971
(Contract NASw-2035)
(NASA-TT-F-14058) Avail: NTIS CSCL 20A

An aircraft-noise-measuring installation developed by several French organizations for full scale measurements of aircraft noise in flight is described. The system uses an extensive measurement chain network equipped with microphones, cinetheodolites, and

magnetic tape recorders. A computer analysis of annoyance level, directivity, and statistical properties of the noise is presented. Author

N72-13988# Department of Transportation, Washington, D.C. Office of Supersonic Transport Development.
AN ANALYSIS OF THE UNITED STATES AEROSPACE AND AIR TRANSPORT INDUSTRIES
17 Mar. 1971 76 p refs
Avail: NTIS

It is stipulated that aerospace and air transport industries are essential to the U.S. economy because they provide the bulwark of the national defense, are the largest single employer, and the backbone of the passenger common carriage system. It is in the public interest for the United States to sponsor research and programs which will keep the U.S. in the forefront of high technology fields and maintain its leadership position on the world market. Aerospace production decrease can result in increased unemployment and reliance on foreign imports. G.G.

N72-13989# Civil Aeromedical Inst., Oklahoma City, Okla.
SURVIVAL IN EMERGENCY ESCAPE FROM PASSENGER AIRCRAFT
Cylde C. Snow, John J. Carroll, and Mackie A. Allgood Oct. 1970 58 p refs
(FAA-AM-70-16) Avail: NTIS

The human factors data from three aircraft accidents involving emergency evacuations are reviewed. Of the 261 passengers aboard, 105 died in attempts to escape during 1- to 3-minutes prior to the build-up of a lethal thermotoxic environment within the cabin. In all three accidents, decelerative forces were mild and cabin destruction and impact injuries minimal. The three most prominent factors influencing survival were found to be: (1) distance between the occupant's seat and the exit he attempts to use, (2) sex, with adult males having a strong advantage, and (3) among adult males, age, with younger males the more frequent survivors. Age and sex are also significant factors in determining the frequency and severity of injuries among survivors. Comparison of the accident evacuations with test evacuations indicate that, in the latter, the biobehavioral factors disadvantageous to elderly males and adult females are not present. Author

N72-13990# National Transportation Safety Board, Washington, D.C.
DELTA AIR LINES, INC. DOUGLAS DC-9-32, N3329L, LOUISVILLE, KENTUCKY, 8 SEPTEMBER 1970
17 Nov. 1971 17 p ref
(NTSB-AAR-71-15; File-1-0016) Avail: NTIS

Delta Air Lines Flight 439, a Douglas DC-9, N3329L, touched down 156 feet short of Runway 29 at Standiford Field, Louisville, Kentucky, September 8, 1970, at 2114, e.d.t., while making a visual landing approach. In the area of the initial impact, the ground sloped upward toward the runway threshold at a 5 percent gradient. After initial impact, the aircraft slid 73 feet on the ground, became airborne, and again touched down, this time on the runway, and the aircraft slid an additional 4457 feet before it came to rest. The aircraft was damaged substantially, and the fuselage had fractured and buckled in the area between fuselage stations 737 and 794. The National Transportation Safety Board determines that the probable cause of this accident was the pilot's misjudgement of altitude due to the absence of sufficient lights in the approach area, misleading information produced by deceptive sloping terrain, and that the pilot did not position the aircraft on the ILS glide slope while he was establushing the final approach profile. Author

N72-13991*# General American Transportation Corp., Niles, Ill.
THE DEVELOPMENT OF A SONIC BOOM SIMULATOR WITH DETONABLE GASES
R. T. Strugielski, L. E. Fugelso, L. B. Holmes, and W. J. Byrne Nov. 1971 177 p refs
(Contract NAS1-9252)
(NASA-CR-1844) Avail: NTIS CSCL 01A

A sonic boom pressure profile was simulated in the far-field by detonation of a methane-oxygen mixture contained in a slender, shaped Mylar envelope. Ideal N-waves were synthesized with peak overpressures from two to five psf and durations of 30 to 75 milliseconds. The detonation of the gas mixture was initiated by a single Primacord strand running the length of balloon. The N-wave producing balloon was synthesized as a composite structure, utilizing experimental pressure profiles obtained from the detonations of slender, axisymmetric balloons with elementary, non-cylindrical shapes. Author

N72-13992# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF SELF ADAPTIVE CONTROL TECHNIQUES IN THE DESIGN OF A NORMAL ACCELERATION CONTROL SYSTEM FOR A HIGH-PERFORMANCE SUPERSONIC AIRCRAFT M.S. Thesis
Richard Robert Paul Jun. 1971 152 p refs
(AD-730162; GGC/EE/71-17) Avail: NTIS CSCL 01/3

The thesis presents a design approach for a self-adaptive normal acceleration control system which is required for a hypothetical aerospace vehicle that operates throughout a wide range of Mach numbers and dynamic pressures. The control problem includes the realistic complications of undesirable structural modes, a nonlinear servoactuator, and the statistical nature of the aircraft stability derivatives and bending mode parameters. A systematic design procedure is developed which employs a servoactuator control loop with a variable gain, in addition to the conventional pitch-rate and normal acceleration control loops, both of which use constant loop gains. The control system is simulated on an analog computer and tested at each flight condition, where variation of the servoactuator loop gain is accomplished manually. At each individual flight condition, this gain is adjusted to the value that would have ordinarily been dictated by an Off-Line Adaptive Computer (OLAC)4 which uses elevator position and pitch-rate measurements from the aircraft to identify and compute changes in elevator effectiveness. Collective examination of the analog results reveals that the aircraft responses to command inputs and wind gust disturbances meet the design specifications for the majority of the flight envelope. Author (GRA)

N72-13993*# National Aeronautics and Space Administration, Washington, D.C.
INFLUENCE OF LIFT AND CRUISE ENGINE DESIGN ON THE TRANSITION CHARACTERISTICS AND GROUND ACOUSTIC FIELD OF VTOL TRANSPORT AIRCRAFT
H. Pakendorf and G. Bottger Jan. 1972 39 p refs Transl. into ENGLISH of "Einfluss der Hub- und Reisetriebwerkauslegung auf die Transition und das Bodenschallfeld Vertikalstartender Transportflugzeuge", German report DGLR-70-040 Presented at Symp. on VTOL Engines, Munich, 22-23 Oct. 1970
(NASA-TT-F-14059; DGLR-70-040) Avail: NTIS CSCL 01B

A transition technique for maximum horizontal acceleration is used to evaluate the influence of engine design and thrust vector control on the transition characteristics. It is shown that the vertical balance of forces in transition, and hence the transition characteristics, are influenced directly by the input-output impulse ratio and by the thrust vector control characteristics of the lift and cruising engines, and indirectly by optimal adaptation of the cruising engines to the cruising flight requirements and by the number of lift and cruising engines installed. A parametric analysis of mixed and direct lift configurations shows that thrust vector control over an angle of at least 30 deg for the lift engines is essential for ensuring safe transition. Author

N72-13994# Sandia Labs., Albuquerque, N.Mex.
SUPERSONIC AND TRANSONIC DEPLOYMENT OF RIBBON PARACHUTES AT LOW ALTITUDES
Randall C. Maydew and Donald W. Johnson [1971] 17 p refs Presented at the Royal Aeron. Soc. Symp., London, 15 Sep.

1971
(SC-DC-714022; Conf-710904-1) Avail: NTIS

Results are presented for twenty-five flight tests of a 22.2-ft (6.8-m) diameter ribbon parachute (reefed for 0.5 sec) with a nominal 2000-lb (907 kg) store. The design, fabrication, and packing of the parachute system are discussed. Low altitude drop tests were made with F-4 and A-4 aircraft at Mach numbers from 0.57 to 1.22, and rocket-boosted tests were made at Mach numbers from 1.62 to 1.70, the latter corresponding to a maximum dynamic pressure of 2720 psf (130 kN/sq m sq). The maximum measured snatch load, reefed stage opening shock, and second stage opening shock were approximately 65 klb (289 kN), 165 klb (734 kN) and 150 klb (667 kN), respectively. The measured load data and sequence of parachute function times are relatively consistent and repeatable. There is no discernible effect of Mach number on the steady state drag area of the reefed parachute at Mach numbers from 0.7 to 1.50.
Author

N72-13995# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aeroelastik.
FLUTTER ANALYSIS OF AIRCRAFT TAKING INTO ACCOUNT THE EFFECTS OF SERVOMECHANISMS
H. Foersching 1971 124 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-37; AVA-FB-7107) Avail: NTIS; DFVLR, Porz: 32,70 DM

The theory and method of flutter analysis of servocontrolled aircraft are presented, taking into account the influences of the servocontrol systems and possible couplings between structural and rigid body vibrations of the airframe and the dynamical behavior of control system elements located within the structure. Based upon the modified two-dimensional flutter system, the basic dynamic relations of hydraulic servocontrol systems and the flight mechanical stability augmentation systems are discussed. The modified aeroservoelastic flutter equations of the entire airplane are derived, and the possibilities of an analytical and analog-digital solution of these equations are considered. Finally, the procedures of the experimental determination of the characteristic servomechanical parameters necessary for aeroservoelastic flutter investigations are discussed.
Author (ESRO)

N72-13996# Boeing Co., Philadelphia, Pa. Vertol Div.
DESIGN STUDIES AND MODEL TESTS OF THE STOWED TILT ROTOR CONCEPT. VOLUME 2: COMPONENT DESIGN STUDIES
Bernard L. Fry Wright-Patterson AFB, Ohio AFFDL Jul. 1971 135 p refs
(Contract F33615-69-C-1577)
(AD-729428; D213-10000-2-Vol-2; AFFDL-TR-71-62-Vol-2) Avail: NTIS CSCL 01/3

This volume presents the results of the detailed component design studies carried out during the latter portion of the Phase I study. General preliminary design criteria is developed from proposed and existing military specifications. A number of potentially critical design conditions are specified for the purpose of preliminary component design and evaluation. Design efforts are concentrated on the determination of component concepts and their evaluation with respect to critical loading conditions, critical design areas such as space envelopes and mechanical complexizy, and the determination of problem areas peculiar to the stowed-tilt-rotor vehicle concept. Components investigated in this study are the wing, nacelle, nacelle tilt mechanism, rotor blade, rotor hub, blade-fold mechanism and power-transmission system.
Author (GRA)

N72-13997# Boeing Co., Philadelphia, Pa. Vertol Div.
DESIGN STUDIES AND MODEL TESTS OF THE STOWED TILT ROTOR CONCEPT. VOLUME 3: APPENDIXES
Bernard L. Fry Wright-Patterson AFB, Ohio AFFDL Jul. 1971 144 p
(Contract F33615-69-C-1577)
(AD-729429; D213-10000-3-Vol-3; AFFDL-TR-71-62-Vol-3) Avail: NTIS CSCL 01/3

This Appendix contains a description of the drag prediction methodology used in this study, minimum parasite drag breakdowns for all the point design aircraft, and detailed performance data for the Design Point 1, 2, and 3 aircraft.
Author (GRA)

N72-13998# Boeing Co., Philadelphia, Pa. Vertol Div.
DESIGN STUDIES AND MODEL TESTS OF THE STOWED TILT ROTOR CONCEPT. VOLUME 1: PARAMETRIC DESIGN STUDIES
Bernard L. Fry Jul. 1971 324 p refs
(Contract F33615-69-C-1577)
(AD-729427; D213-10000-1-Vol-1; AFFDL-TR-71-62-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 01/3

The stowed-tilt-rotor stoppable rotor concept offers great potential for three missions requiring 2 combinations of relatively low downwash characteristics, good hover efficiency, and relatively high cruise speed and efficiency. These missions are high-speed long-range rescue, capsule recovery, and VTOL medium transport. The present study will provide information on design criteria including the size and configuration of aircraft required to fulfill each of the three missions. The current study indicates that there is reasonable compatibility between the rescue and capsule recovery aircraft because their speed capabilities and required useful loads are similar. However, a much larger aircraft is required to accommodate all three missions. (A reduction in cargo box size for the transport mission can however provide a single compromise airframe size.) Consequently, a baseline configuration has been selected with a common lift/propulsion system combined with different fuselages for rescue aircraft and medium transport aircraft. The compromise made in the transport fuselage box size still provides a capacity in excess of most current medium transports, both helicopter and fixed-wing.
Author (GRA)

N72-13999# Army Foreign Science and Technology Center, Charlottesville, Va.
SPECIFICS OF AERODYNAMICS OF THE LIFTING ROTOR OF A HELICOPTER
A. M. Mkhitaryan 4 Aug. 1971 16 p Transl. into ENGLISH from the publ. "Aerodinamika" Moscow, 1970
(AD-729587; FSTC-HT-23-1348-71; T702301-2301) Avail: NTIS CSCL 01/3

Depending on the aerodynamic plan of a helicopter, there are many designs for lifting rotors, providing for performance of its varied functions. Particular attention is given to inclined air-stream incidence to the rotor.
GRA

N72-14000# Minnesota Univ., Minneapolis.
STABILITY AND DRAG OF PARACHUTES WITH VARYING EFFECTIVE POROSITY Final Report, Jun. 1958 - Jun. 1961
Helmut G. Heinrich and Eugene L. Haak Wright-Patterson AFB, Ohio AFFDL Feb. 1971 78 p refs Supersedes AD-288572, ASD-TDR-62-100
(Contract AF 33(616)-8310; AF Proj. 6065)
(AD-729858; AD-288572; ASD-TDR-62-100; AFFDL-TR-71-58; Task-606503) Avail: NTIS CSCL 01/3

The tangent force, normal force, and moment coefficients versus the angle of attack of ten different types of parachutes were determined by means of wind tunnel measurements. Models formed from sheet metal as well as made out of non-porous and porous cloth were used. The nominal porosity of the cloth varied from 10 to 275 cu ft/sq ft min under a differential pressure of 1/2 inch of water. This corresponds to a range of effective porosity from 0.003 to 0.096. The aerodynamic coefficients were related to the effective and nominal porosity characteristics expressed as derivatives with respect to the porosity term. It was found that the static stability of all types of parachutes could be significantly improved through higher

porosity, although this reduces slightly the air resistance for the parachute. Author (GRA)

N72-14001# United Aircraft Corp., Stratford, Conn.
ADVANCED ANTITORQUE CONCEPTS STUDY Final Technical Report, Jun. 1970 - Jan. 1971
Arthur W. Grumm and Groves E. Herrick Jul. 1971 166 p refs
(Contract DAAJ02-70-C-0049)
(AD-729860; SER-50697; USAAMRDL-TR-71-23; Task-1F162204AA4405) Avail: NTIS CSCL 01/3

The report summarizes a study of possible alternatives to the tail rotor on single-rotor shaft-driven helicopters. The objective was to select concepts that show improvements over the tail rotor in high-speed dynamics, vulnerability, reliability and maintainability, safety, and at a lower priority level, acoustic detectability, and erosion and foreign object damage. These characteristics were to be obtained without incurring unacceptable penalties in aircraft weight, performance, or cost. The stability and control criteria of MIL-H-8501A were imposed throughout. Author (GRA)

N72-14002# North American Rockwell Corp., Columbus, Ohio.
AN INVESTIGATION OF LANDING GEAR - SOFT SOIL INTERACTION UTILIZING THE OV-10A AIRCRAFT Final Technical Report, Nov. 1968 - Jan. 1970
Charles E. Cook and Joseph D. Gargiulo Jan. 1971 383 p refs
(Contract N00019-69-C-0063)
(AD-729685; NR-70H-570) Avail: NTIS HC $6.00/MF $0.95 CSCL 01/2

The results of an investigation of the interaction between landing gear and soft soil are presented. The OV-10A aircraft was used to perform sixteen landings and takeoffs on soft unprepared terrain at Blackstone Army Air Base, Virginia. Two fifty channel oscillographs were used to measure time histories of the airplane response. Measurements were also taken of the terrain contour and static and dynamic strengths of the soil. Equations of motion are presented for a mathematical model of the OV-10A landing and taking off from yieldable uneven terrain. The model simulates the soil-tire interactions, landing gear-airplane interactions, and the airplane dynamic response. A system of 20 nonlinear, coupled second order differential equations results. Author (GRA)

N72-14003# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VARIABLE SWEEP
S. Yu. Skripnichenko 20 Jul. 1971 54 p refs Transl. into ENGLISH from the Monograph Izmenyaemaya Strelovidnost, Moscow, 1969 p 73-120
(AD-730043; FTD-MT-24-23-71) Avail: NTIS CSCL 01/3

Contents: About the problems of producing aircraft with the changeable sweepback wing; Military aircraft of western countries with changeable sweepback wing; About the prospects of the use of the changeable sweepback wing on the military aircraft. GRA

N72-14004# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
DEVELOPMENT OF ADVANCED TECHNIQUES FOR THE IDENTIFICATION OF V/STOL AIRCRAFT STABILITY AND CONTROL PARAMETERS Final Report, May 1969 - Dec. 1970
Robert T. N. Chen, Bernard J. Eulrich, and J. Victor Lebacoz Aug. 1971 353 p refs
(Contract N00019-69-C-0534)
(AD-730121; CAL-BM-2820-F-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 01/3

Contemporary analyses of transition flight of V/STOL aircraft are based on aerodynamic data measured in a wind tunnel or on analytical prediction using methods developed for conventional aircraft. The validity and accuracy of these techniques for V/STOL aircraft has not yet been established, and it is essential that they be correlated with flight test data through parameter identification. In spite of the complicated nature of V/STOL dynamics in transition, some method of identifying these characteristics is required. This report documents the development of identification techniques to meet this requirement. The report first presents the selection of a mathematical model to represent a V/STOL aircraft (the X-22A). This is followed by a discussion of available identification techniques. Based upon a thorough knowledge of the requirements of this program and the limitations of the available techniques, advanced techniques suitable for identification of V/STOL aircraft stability and control parameters are developed. Author (GRA)

N72-14005# Air Force Flight Test Center, Edwards AFB, Calif.
METHODS OF AUDITORY DISPLAY FOR AIRCRAFT COLLISION AVOIDANCE SYSTEMS Final Report
Richard G. Hector Aug. 1971 77 p refs
(AD-729765; AFFTC-TD-71-3) Avail: NTIS CSCL 01/2

When two aircraft are physically oriented so that continuation on their individual flight paths will result in collision, the final decision of the pilot to take avoiding action is most often based on visual detection of the other aircraft. Considerable laboratory experimentation has been conducted and reported on various aspects of visual detection, although little has been reported on methods to aid the pilot in visual searching. A head-up aid is desirable, rather than an in-the-cockpit display. For this reason, an auditory display was investigated. The display requires auditory localization in both the horizontal and vertical dimensions. Experimentation was conducted to determine physical factors of localization in the vertical plane. The results of the research and experimentation indicated that the external portion of the ear, the pinna, imposes a pattern of organization on tye high frequencies of the sound whose source is located vertically. Specifically, this pattern is a shift in the dominant frequencies and attenuated frequencies with change in elevation. This knowledge allowed the proposal of a full two-dimension stereophonic auditory display for the pilot to localize the intruding aircraft. Author (GRA)

N72-14006# Dynamic Science, Phoenix, Ariz.
STUDY TO DETERMINE THE APPLICATION OF AIRCRAFT IGNITION SOURCE CONTROL SYSTEMS TO FUTURE ARMY AIRCRAFT Final Report
John K. Drummond Fort Eustis, Va. AAMRDL Jun. 1971 57 p refs
(Contract DAAJ02-69-C-0030; DA Proj. 1F1-62203-A-529)
(AD-729870; AVSER-4200-17-10; USAAMRDC-TR-71-35) Avail: NTIS CSCL 13/12

The report presents the results of a program that was conducted to provide design information applicable to future Army aircraft relative to crash sensors, ignition-source suppression systems, and circuitry for the automatic activation of the suppression systems. The program involved a comprehensive literature search, the development of requirements for the initiating subsystem of the overall ignition source control system, and the consideration and comparison of several illustrative activating circuits. The development of a workable ignition-source suppression system was found to be feasible. Several systems have already been developed to cool hot surfaces, to inert atmospheres, and to de-energize electrical systems. The areas of the ignition-source control problem which require development are: the selection and the degree of redundancy of crash sensors, the locations of the sensors on the aircraft, and the complexity of the activating and control circuitry. Author (GRA)

N72-14007# Systems Technology, Inc., Hawthorne, Calif.
ANALYSIS OF LIMITED AUTHORITY MANUAL CONTROL SYSTEM Final Report, Sep. 1969 - Jun. 1970
Lee Gregor Hofmann, Kishor V. Shah, and Dunstan Graham Wright-Patterson AFB, Ohio AFFDL Jul. 1971 253 p refs
(Contract F33615-70-C-1075; AF Proj. 8219)
(AD-729869; STI-TR-194-1; AFFDL-TR-71-6) Avail: NTIS CSCL 01/3

Systematic procedures for predicting pilot-vehicle-flight

control system performance and proneness to pilot induced oscillations and instabilities are here developed and applied to examples. The systems analyzed have very limited maximum control surface rates and deflections. Performance analysis is by means of applying random input describing function theory to predict the root mean square level of key system variables as a function of the control surface rate and deflection limit levels. Acceptable limit levels are only two to three times the root mean square value of the variable at the point in the system where each limiter nonlinearity occurs. Results of analyzing three minimum back-up manual flight control system modifications for the F-4 C are compared with data from piloted fixed-base simulator experiments for the same system configurations.

Author (GRA)

N72-14008# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
AN IN-FLIGHT INVESTIGATION OF LATERAL-DIRECTIONAL DYNAMICS AND ROLL-CONTROL POWER REQUIREMENTS FOR THE LANDING APPROACH Final Report
C. Warren Hall and Edward M. Boothe Oct. 1970 180 p refs
(Contract F33615-69-C-1664; Contract DOTFA69WA-163; AF Proj. 8219)
(AD-725461; CAL-BM-2821-F-5-A; FAA-RD-71-26; Task-821905) Avail: NTIS CSCL 01/2

Lateral-directional handling qualities and roll control power requirements for the executive jet class of airplanes in the landing approach flight phase were investigated in the USAF/CAL variable stability T-33 airplane. Particular emphasis was placed on the effects of crosswinds and turbulence. Simulated IFR ILS approaches and VFR offset and crosswind approaches were made. Specifically, two Dutch roll frequencies, three Dutch roll damping ratios, three roll-to-sideslip ratios, and three roll mode time constants were investigated. It was found that for the range of parameters investigated, lateral-directional dynamics do not establish a limiting crosswind value; however, they do determine the ease or difficulty with which a crosswind apprbach can be accomplished. Roll control power requirements were determined from actual control usage data obtained throughout the evaluation program and were found to be a function of the lateral-directional dynamics. Minimum acceptable levels of roll control power were determined by reevaluating a number of configurations with limited roll control power. It was found that available roll control power can establish a limiting crosswind component.

Author (GRA)

N72-14009# Federal Aviation Administration, Washington, D.C.
CONGRESSIONAL AIR TRANSPORTATION CONGESTION STUDY, PART 1
1971 184 p refs
(AD-725326) Avail: NTIS CSCL 01/2

House of Representatives Report No. 91-1115 directed the Department of Transportation, in close collaboration with the Civil Aeronautics Board, to study the problem of aircraft traffic during prime travel hours and the extent to which this concentration results from unrealistic scheduling of flights by the airlines. The resultant effects on safety and controller staffing were to be investigated. This report presents the findings, conclusions, and recommendations of the two agencies concerning the problem.

Author

N72-14010# Mechanics Research, Inc., Los Angeles, Calif.
STABILITY AND CONTROL OF HELICOPTERS IN STEEP APPROACHES. VOLUME 1: SUMMARY REPORT Final Report
Julian Wolkovitch and John A. Hoffman May 1971 186 p refs 4 Vol.
(Contract DAAJ02-69-C-0004; DA Proj. 1F1-62204-a-142)
(AD-729847; MRI-2284-1-Vol-1; USAAVLABS-TR-70-74A) Avail: NTIS CSCL 01/3

Aerodynamics and control characteristics of helicopters in level flight and steep descents at low speeds are analyzed. Single-rotor, tandem-rotor, and compound helicopters are considered and are specifically represented by the S-58, AH-56A, and YHC-1A, for each of which derivatives and transfer functions are presented. New analytic methods are used to describe the flow about descending rotors. Using these methods, predictions are made of the boundaries of the vortex-ring state and of tip loss factors. Good agreement with experiment is obtained. A new modular stability derivative program, MOSTAB, is described and is used to calculate derivatives for the S-58 and AH-56A, including lateral-longitudinal cross-coupling derivatives. It is shown that, for these helicopters, control of flight path by collective pitch becomes difficult for low-speed steep descents even with stability augmentation, due to a nonminimum phase transfer function and the associated wrong-way step response characteristic. The effect is identified as an important factor in the observed degradation of flying qualities in steep approaches.

Author (GRA)

N72-14011# Mechanics Research, Inc., Los Angeles, Calif.
STABILITY AND CONTROL OF HELICOPTERS IN STEEP APPROACHES. VOLUME 2: THE MOSTAB PROGRAM Final Report
Julian Wolkovitch and John A. Hoffman May 1971 203 p refs 4 Vol.
(Contract DAAJ02-69-C-0004; DA-Proj. 1F1-62204-A-142)
(AD-729848; MRI-2284-1-Vol-2; USAAVLABS-TR-70-74B) Avail: NTIS CSCL 01/3

The general approach used in the MOSTAB modular stability derivative program is described. Details are presented of the aerodynamic representations of modular aircraft elements such as bodies and lifting surfaces, and the rotor dynamic equations are explained. A listing of the MOSTAB program (MOSTAB B version) is given.

Author (GRA)

N72-14012# European Research Office, London (England).
VISIT TO SIAI-MARCHETTI, SESTO-CALENDE/VERGIATE (VARESE), ITALY
Richard L. Scharpf 13 Aug. 1971 7 p
(AD-729377; Fro-9-1971) Avail: NTIS CSCL 01/3

The report describes the SV-20 helicopter being developed by SIAI-Marchetti, Italy. A visit was made to become familiar with the concept and with the development status.

Author (GRA)

N72-14013# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
CREW COMPARTMENT VIBRATION ENVIRONMENT IN THE B-58 AIRCRAFT DURING LOW ALTITUDE, HIGH SPEED FLIGHT Final Report, Jul. 1966 - Dec. 1970
Jerry D. Speakman and Justus F. Rose, Jr. Jul. 1971 201 p refs
(AF Proj. 7231)
(AD-730288; AMRL-TR-71-20) Avail: NTIS CSCL 01/3

Measurements were made of the crew compartment vibration environment experienced in the B-58 aircraft during low-altitude, high-speed flight. Data were obtained of the longitudinal, lateral and vertical linear accelerations and the roll axis angular velocites and accelerations present during five flights made in July 1966. The terrain contour following flights at 500 to 900 feet above the flat to semi-mountainous regions of Louisiana and Arkansas were conducted at 450 knots true airspeed. Data analyses included probability density and distribution and the auto-power spectral density functions in addition to tests for stationarity, randomness and normality. The individual degree-of-freedom results are presented in graphical and tabular form and allow evaluation of operational flight environments and exposure conditions in terms of existing tentative vibration exposure criteria for various crew functions. They will also form the urgently required basis for simulating these environments for further biomedical laboratory research on human tolerance and performance.

Author (GRA)

N72-14014# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN INVESTIGATION OF CROSS-COUPLING THE ELEVATORS AND THROTTLE SYSTEMS FOR THE KC-135 AIRCRAFT IN THE LANDING CONFIGURATION M.S.Thesis

Ronald Edward Goodfellow Jun. 1971 127 p refs
(AD-730153; GGC/EE/71-8) Avail: NTIS CSCL 01/3

The purpose of this study was to investigate the possibility of using cross-coupling methods as additional controls during automatic landing approaches. This investigation was for aircraft that have the engine thrust line below the center of gravity of the aircraft. The KC-135 aircraft dynamics were used in this study. Three methods of cross-coupling were investigated. These methods were the cross coupling of a thrust signal into the elevator system; the cross-coupling of the glide slope beam error signal into the engine system; and a combination of these two methods. This study showed that the pitch handling characteristics of the aircraft in the landing configuration were improved with all three of the methods investigated. Author (GRA)

N72-14015# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DESIGNING A CONTROL AUGMENTATION SYSTEM FOR THE H-53 HELICOPTER M.S. Thesis

Robert W. Radloff 1971 124 p refs
(AD-730160; GGC/EE/71-20) Avail: NTIS CSCL 01/3

The thesis presents the procedures used in designing a control augmentation system (CAS) for the H-53 helicopter. The conventional root locus design techniques, along with an analog computer simulation, were used to design the system. Two control loops were formed; the height rate control loop (collective pitch control) and the pitch control loop (cyclic pitch control). When both loops are closed the helicopter does not respond correctly to pitch commands. The problem of improper height response during pitch commands was solved by cross coupling some of the pitch command to the height control loop. The results show that a simple CAS is feasible and desirable to improve the controllability of present day helicopters.

Author GRA

N72-14016# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A STUDY OF THE PRACTICALITY OF ACTIVE VIBRATION ISOLATION APPLIED TO AIRCRAFT DURING THE TAXI CONDITION M.S. Thesis

Charles Dominic Corsetti Jun. 1971 164 p refs
(AD-730141; GGC/EE/71-6) Avail: NTIS CSCL 01/3

The feasibility of using an active control in the landing gear system of an aircraft to reduce wing fatigue damage resulting from ground induced vibration S during taxiing is considered. The characteristics of three vehicle models are discussed; a single landing gear system, a tricycle landing gear system and a system of five landing gears. Mathematical expressions for the runway inputs to each vehicle model are obtained in the form of random inputs represented by Gauss-Markov processes. The model for a linear hydraulic actuat or which is used as the active control element in the landing gear system is presented. The results indicate that the combined optimal active control parameters that are necessary and desirable in the optimal system, together with the physical demands placed on the actuator, are determined. Author (GRA)

N72-14017# Wyle Labs., Inc., Hampton, Va.

HELICOPTER AURAL DETECTABILITY Final Report

John B. Ollerhead Jul. 1971 198 p refs
(Contract DAAJ02-69-C-0083; DA Proj. 1F1-62204-A-142)
(AD-730788; WR-71-3; USAAMRDL-TR-71-33;
Task-1F162204-A-14235) Avail: NTIS CSCL 17/1

The principal objective of the study is to develop the methodology for the prediction of helicopter aural detection thresholds from measured or estimated parameters of significance. The subjective aspects of helicopter noise are discussed. A review is presented of the effects of atmospheric and terrain features upon the observed sound, and of the limitations in the measurement and analysis of helicopter noise. An experimental program is described, in which a group of subjects listened to a large number of synthetic and recorded helicopter sounds inside a specially designed acoustic chamber. Through these experiments, a model for calculating aural detection thresholds is developed, tested, and found to be accurate to within plus or minus 4dB. Appendices to the report include detailed instructions for applying several versions of the developed method and also provide simplified procedures for estimating propagation losses.

Author (GRA)

N72-14018# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

AN EXPERIMENTAL STUDY OF HELICOPTER ROTOR IMPULSIVE NOISE Final Report

William E. Bauch, Charles L. Munch, and Ronald G. Schlegel Jun. 1971 245 p refs
(Contract DAAJ02-69-C-0035; DA Proj. 1F1-62204-A-142)
(AD-730359; USAAVLABS-TR-70-7223;
Task-1F162204-A-14235) Avail: NTIS CSCL 20/1

Results of a study of helicopter rotor impulsive noise (RIN) are presented. Rotor noise, together with rotor blade dynamic and pressure data, was measured during hover and cruise of a CH-53A helicopter for use in a correlation study of calculated and measured noise. In addition, the rotor rotational noise analysis described in U. S. Army Aviation Materiel Laboratories (USAAVLABS) Technical Report 70-1B was modified to reduce computation time and to include blade flapping and coning motions. The inclusion of these motions, however, is shown to have little effect on the predicted noise. Correlation of calculated and measured noise harmonic amplitudes is generally within 5 dB through the third harmonic at distances less than 1000 feet in front of the helicopter. Waveform correlation of calculated and measured time histories of acoustic pressure is good. RIN is identified as being primarily a rotational noise phenomenon, ordered at the blade passage frequency and its harmonics, rather than amplitude modulated broadband noise. Hover RIN is shown to be due to vortex interference (blade/wake interaction RIN), while cruise RIN is shown to be due to the combination of acoustic effects of a high subsonic tip Mach number on wave propatation and blade drag, and is referred to as advancing blade RIN. Author (GRA)

N72-14019# Mechanics Research, Inc., Los Angeles, Calif.

STABILITY AND CONTROL OF HELICOPTERS IN STEEP APPROACHES. VOLUME 3: DERIVATIVES AND TRANSFER FUNCTIONS FOR THE YHC-1A TANDEM-ROTOR HELICOPTER AND THE S-58 SINGLE-ROTOR HELICOPTER Final Report

Julian Wolkovitch and John A. Hoffman May 1971 303 p refs
(Contract DAAJ02-69-C-0004; DA Proj. 1F1-62204-A-142)
(AD-730362; MRI-2284-1-Vol-3; USAAVLABS-TR-70-74C)
Avail: NTIS HC $6.00/MF $0.95 CSCL 01/3

Derivatives and transfer functions are presented for the Boeing-Vertol YHC-1A tandem-rotor helicopter and for the Sikorsky S-58 single-rotor helicopter. The flight conditions considered for the YHC-1A include forward speeds from 0 to 80 knots and descent rates from 0 to 25 fps. For the S-58 forward speeds of 0 to 100 knots and descent rates of 0 to 22.5 fps are considered. Author (GRA)

N72-14020# Lockheed-Georgia Co., Dawsonville.

STABILITY AND CONTROL OF HELICOPTERS IN STEEP APPROACHES. VOLUME 4: DERIVATIVES AND TRANSFER FUNCTIONS FOR THE AH-56A COMPOUND HELICOPTER AND DATA ON LOW ALTITUDE TURBULENCE REPRESENTATION Final Report

Julian Wolkovitch and John A. Hoffman May 1971 206 p refs
(Contract DAAJ02-69-C-0004; DA Proj. 1F1-62204-A-142)

(AD-730363; MRI-2284-1-Vol-4;
USAAVLABS-TR-70-740-Vol-4) Avail: NTIS CSCL 01/3

Derivatives and transfer functions are presented for the Lockheed AH-56A helicopter. The flight conditions considered include airspeeds of from 0 to 100 knots and descent rates from 0 to 28.8 fps. A critical review is given of data on low altitude turbulence. Author (GRA)

N72-14021# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

AN EXPERIMENTAL INVESTIGATION OF COMPOUND HELICOPTER AERODYNAMICS IN LEVEL AND DESCENDING FORWARD FLIGHT AND IN GROUND PROXIMITY Final Data Report

William F. Putman and Joseph J. Traybar Jul. 1971 318 p refs

(Contract DAAJ02-67-C-0025; DA Proj. 1F1-62204-A-142)
(AD-730364; AMS-971; USAAMRDL-TR-71-19) Avail: NTIS HC $6.00/MF $0.95 CSCL 01/1

A series of experiments was performed on the Princeton Dynamic Model Track on a compound helicopter model with an 8-foot-diameter hingeless rotor. Rotor, wing and fuselage forces and moments were measured as functions of advance ratio, rotor angle of attack, and collective pitch at various combinations of wing size and position, including wing off and wing and fuselage off. Test conditions included forward level flight, partial-power steep descent, and slow longitudinal and lateral flight in ground proximity. The results of these experiments are presented as functions of advance ratio in nondimensional coefficient form based on rotor tip speed and an appropriate characteristic area, such as rotor area or wing area. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-14022*# General Electric Co., Lynn, Mass. Aircraft Equipment Div.

FUEL CELL TECHNOLOGY PROGRAM Final Report, Jul. 1970 - Aug. 1971

25 Sep. 1971 145 p
(Contract NAS9-11033)
(NASA-CR-115300; SPR-044; Data-Item-35) Avail: NTIS CSCL 10C

The results of a solid polymer electrolyte fuel cell development program are summarized. A base line design was defined, and materials and components of the base line configuration were fabricated and tested. Concepts representing base line capability extensions in the areas of life, power, specific weight and volume, versatility of operation, field maintenance, and thermal control were identified and evaluated. Liaison and coordination with space shuttle contractors resulted in the exchange of engineering data. Author

N72-14023*# Translation Consultants, Ltd., Arlington, Va.

LOSS OF ACTIVITY OF THE OXYGEN ELECTRODE BASED ON THE SILVER CATALYST/PTFE SYSTEM

M. Cenek and O. Kouril Washington NASA Dec. 1971 62 p refs Transl. into ENGLISH of a Tech. Univ. of Brno (Czechoslovakia). Inst. of Electrotech. report, 1971 59 p
(Contract NASw-2038)
(NASA-TT-F-13950) Avail: NTIS CSCL 10A

Effects of electrolyte impurities and impurities from dissolution of cell components on the activity of the oxygen electrode in strongly alkaline electrolytes were determined because of the decrease in performance of low-temperature fuel cells with time. Determination was a prerequisite for using oxygen electrodes prepared from silver catalyst polymeric binder blends. Results showed, however, that the oxygen electrode of this composition is practically useless for application in electrochemical systems. Author

N72-14024*# Naval Ammunition Depot, Crane, Ind.

EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: ACCEPTANCE TESTS OF EAGLE-PICHER 12.0 AMPERE-HOUR NICKEL-CADMIUM CELLS WITH AUXILIARY ELECTRODES

D. E. Christy 8 Dec. 1971 24 p ref
(NASA Order W-12397)
(NASA-CR-124744; QUEEL/C-71-366) Avail: NTIS CSCL 10C

An acceptance test program was conducted on 24 cells to insure that all cells put into the life cycle program were of high quality by the removal of cells found to have electrolyte leakage, internal shorts, low capacity, or inability of any cell to recover its open circuit voltage above 1.150 volts after the cell short test. The cells were rated at 12.0 ampere-hours and equipped with auxiliary electrodes. Test results were: (1) The capacity of the 24 cells ranged from 14.6 to 16.8 ah. All the cells exceeded the rated capacity on all three capacity checks. (2) One cell failed to recover to 1.150 volts after the cell short test. (3) During the overcharge tests, all cells but one failed the test at the c/10 rate after the first minute. (4) A special resistance test was conducted on the auxiliary electrodes of these cells to establish the resistance value necessary which would provide maximum signal power across the auxiliary electrode. The resistance value established was 10 ohms. (5) No electrolyte leakage was observed. Author

N72-14025*# Scientific Translation Service, Santa Barbara, Calif.

GONDOLA SUPPLY OF EOLE BALLOONS: BALANCE OF POWER CALCULATIONS

J. Bezaudun Washington NASA Feb. 1971 25 p refs Transl. into ENGLISH of "Alimentation des Nacelles des Ballons Eole Calcul du Bilan de Puissance", Natl. Center for Space Studies, Bretigny, France, report 71/CT/TA/EB/EOLE-B/O.809
(Contract NASw-2035)
(NASA-TT-F-13855; Rept-71/CT/TA/EB/EOLE-B/O.809) Avail: NTIS CSCL 10C

Daily output, temperature, maximum current and power balance of a battery in the Eole balloon were calculated from 1 August 1971 to 1 March 1972. Author

N72-14026*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CORONA INCEPTION VOLTAGE IN STATORETTES WITH VARIOUS GAS-SOLID DIELECTRIC SYSTEMS

Gary Bollenbacher and Erwin E. Kempke, Jr. Washington Jan. 1972 19 p refs
(NASA-TM-X-2474; E-6582) Avail: NTIS CSCL 20C

Corona inception voltage was calculated and measured for three statorettes in several gases and gas mixtures at pressures from 50.8 to 1270 torr. In helium the corona inception voltage was lowest, and in air it was highest. In argon and mixtures of helium and xenon the corona inception voltage was between that of air and helium. Correlation between experimental and calculated data was good. Author

N72-14027*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPUTER CONTROLLED PERFORMANCE MAPPING OF THERMIONIC CONVERTERS: EFFECT OF COLLECTOR, GUARD-RING POTENTIAL IMBALANCES ON THE OBSERVED COLLECTOR CURRENT-DENSITY, VOLTAGE CHARACTERISTICS AND LIMITED RANGE PERFORMANCE MAP OF AN ETCHED-RHENIUM, NIOBIUM PLANAR CONVERTER

Eugene J. Manista Washington Jan. 1972 15 p refs

(NASA-TM-X-2480; E-6446) Avail: NTIS CSCL 10B

The effect of collector, guard-ring potential imbalance on the observed collector-current-density J, collector-to-emitter voltage V characteristic was evaluated in a planar, fixed-space, guard-ringed thermionic converter. The J,V characteristic was swept in a period of 15 msec by a variable load. A computerized data acquisition system recorded test parameters. The results indicate minimal distortion of the J,V curve in the power output quadrant for the nominal guard-ring circuit configuration. Considerable distortion, along with a lowering of the ignited-mode striking voltage, was observed for the configuration with the emitter shorted to the guard ring. A limited-range performance map of an etched-rhenium, niobium, planar converter was obtained by using an improved computer program for the data acquisition system. Author

N72-14028*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPUTER ACQUIRED PERFORMANCE DATA FROM AN ETCHED-RHENIUM, MOLYBDENUM PLANAR DIODE

Eugene J. Manista Washington Jan. 1972 15 p refs

(NASA-TM-X-2481; E-6610) Avail: NTIS CSCL 10B

Performance data from an etched-rhenium, molybdenum thermionic converter are presented. The planar converter has a guard-ringed collector and a fixed spacing of 0.254 mm (10 mils). The data were acquired by using a computer and are available on microfiche as individual or composite parametric current, voltage curves. The parameters are the temperatures of the emitter T sub E, collector T sub C and cesium reservoir T sub R. The composite plots have constant T sub E, and varying T sub C or T sub R, or both. The envelope and composite plots having constant I sub E are presented. The diode was tested at increments between 1500 and 2000 K for the emitter, 750 and 1100 K for the collector, and 540 and 640 K for the reservoir. In all, 774 individual current, voltage curves were obtained. Author

N72-14029*# Boeing Co., Seattle, Wash. Aerospace Group.

SIMULATED SPACE ENVIRONMENT TESTS ON CADMIUM SULFIDE SOLAR CELLS Final Report

David R. Clarke and Henry Oman [1971] 229 p refs

(Contract NAS3-11838)

(NASA-CR-120840; D180-12700-1) Avail: NTIS CSCL 10A

Cadmium sulfide (Cu2s - CdS) solar cells were tested under simulated space environmental conditions. Some cells were thermally cycled with illumination from a Xenon-arc solar simulator. A cycle was one hour of illumination followed immediately with one-half hour of darkness. In the light, the cells reached an equilibrium temperature of 60 C (333 K) and in the dark the cell temperature dropped to -120 C (153 K). Other cells were constantly illuminated with a Xenon-arc solar simulator. The equilibrium temperature of these cells was 55 C (328 K). The black vacuum chamber walls were cooled with liquid nitrogen to simulate a space heat sink. Chamber pressure was maintained at 0.000001 torr or less. Almost all of the solar cells tested degraded in power when exposed to a simulated space environment of either thermal cycling or constant illumination. The cells tested the longest were exposed to 10,050 thermal cycles. Author

N72-14030*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ATS-5 SOLAR CELL EXPERIMENT RESULTS AFTER ONE YEAR IN SYNCHRONOUS ORBIT

B. E. Anspaugh 1 Jan. 1972 45 p refs

(Contract NAS7-100)

(NASA-CR-125061; JPL-TM-33-522) Avail: NTIS CSCL 10A

The results of the ATS-5 solar cell experiment after one year in synchronous orbit are reported. A partial failure in the experimental electronics package has caused a loss of data from half the 80 experimental solar cells. Procedures for extracting data due to a partial spacecraft failure are described and discussed. Data from the remaining 40 solar cells, including 15 mounted on a thin flexible structure are analyzed. Data are corrected to a solar intensity of 140 mW/sq cm and a temperature of 25 C. It was found that after one year in synchronous orbit: (1) cells with 1.52-mm-thick coverslides did not show a clear-cut advantage over those with 0.15-mm coverslides, (2) cells with solderless grid lines are degrading at the same rate as are cells with solder-dipped grid lines, (3) cells not quite completely covered with coverslides suffered a large power loss in comparison to cells fully covered, (4) no clear-cut advantage of 10-cm cells over 2-cm cells has yet been observed, (5) cells mounted on the flexible panel with relatively little backshielding did not degrade any faster than those with substantial backshielding, and (6) the flight data in large part confirms the adequacy of the ground-based techniques used in our preflight radiation test program. Author

N72-14031*# Techtran Corp., Glen Burnie, Md.

EOLE BALOON: SUMMARY OF PRINCIPAL TESTS PERFORMED ON BATTERIES FOR THE EOLE BALLOONS

J. P. Dulmo, (ed.) Washington NASA Dec. 1970 11 p Transl. into ENGLISH from Report by Natl. Space Study Center, Toulouse Space Center, Div. of Aerospace Techniques, Space Vehicle Power Supply Dept. (Bretigny), 29 Sep. 1970 10 p

(Contract NASw-2037)

(NASA-TT-F-13835; Rept-70/CT/TA/EB/0.672/EOLE/B) Avail: NTIS CSCL 10C

Mechanical and electrical characteristics of batteries for Eole balloon nacelles were measured at various temperatures. It was found that overcharging eventually caused the battery to dry up. Author

N72-14032*# Scientific Translation Service, Santa Barbara, Calif.

EOLE BALLOON SOLAR GENERATORS

J. Bezaudun, ed. Washington NASA Dec. 1970 13 p Transl. of "Generateurs Solaires Eole-Balloons" Rept-70/CT/TA/EB/0.671/Eole/B CNES, Centre Spatial de Toulouse. Div. Tech. Aerospatiales, Dept. Energie de Bord, Bretigny, 28 Sep. 1970 8 p

(Contract NASw-2035)

(NASA-TT-F-13836; Rept-70/CT/TA/EB/0.671/Eole/B) Avail: NTIS CSCL 10A

The results of qualification tests carried out with Eole balloon solar generator components are described. These include mechanical, electrical, environmental, and launch simulation tests. The components were found to be acceptable. Author

N72-14033*# Scripta Technica, Inc., Washington, D.C.

COMPATIBILITY TESTS: ELECTRONIC-BATTERY DESTRUCTION TEMPERATURE

R. Cuinet Washington NASA Feb. 1971 9 p Transl. into ENGLISH of "Essais de Compatibilite Electronique-Batterif-Destruction en Temperature" Rept. 009/CST/BA/NA/IE Centre Natl. d'Etudes Spatiales, 12 Jan. 1971 9 p

(Contract NASw-2036)

(NASA-TT-F-13850) Avail: NTIS CSCL 10C

Performance tests to determine the voltage required to initiate destruct devices on the EOLE balloon are described. Eight tests were successfully completed. The values of voltage required were determined and the operation of the electrical equipment is analyzed. Author

N72-14034*# Heliotek, Sylmar, Calif.

DEVELOPMENT OF INTEGRAL COVERS ON SOLAR CELLS Final Report, Jun. 1970 - Jun. 1971

P. Stella and H. Somberg Jul. 1971 57 p

(Contract NAS5-21510)

(NASA-CR-122316; rept-3) Avail: NTIS CSCL 10A

The electron-beam technique for evaporating a dielectric material onto solar cells is investigated. A process has been developed which will provide a highly transparent, low stress, 2 mil thick cover capable of withstanding conventional space type

qualification tests including humidity, thermal shock, and thermal cycling. The covers have demonstrated the ability to withstand 10 to the 15th power 1 MeV electrons and UV irradiation with minor darkening. Investigation of the cell AR coating has produced a space qualificable titanium oxide coating which will give an additional 6% current output over similar silicon oxide coated cells when covered by glass. Author

N72-14035*# Naval Ammunition Depot, Crane, Ind. Electrochemical Power Sources Branch.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS. ACCEPTANCE TEST OF GENERAL ELECTRIC COMPANY 6.0 AMPERE-HOUR NICKEL-CADMIUM CELLS
D. E. Christy 1 Jun. 1971 22 p
(NASA Order W-12397)
(NASA-CR-122318; QE/C-71-187) Avail: NTIS CSCL 10A

Acceptance tests were made on 25 cells to provide a base line reference prior to life cycling. The test results are presented and include data regarding physical dimensions, electrolyte leakage, cell capacity, internal shorts, ability to withstand long periods of overcharge, and internal resistance measurements.
D.L.G.

N72-14036# Electrical Research Association, Leatherhead (England).
DEVELOPMENT OF INTEGRAL COVERS FOR SILICON SOLAR CELLS Interim Report No. 2
G. Brackley, K. Lawson, S. Shaw, and D. W. Satchell Paris ESRO Sep. 1970 51 p refs
(Contract ESTEC-810/69)
(ESRO-CR-32-IR-2) Avail: NTIS

Integral covers for silicon solar cells were prepared by sputtering layers of Corning 7740 and Schott 8330 glasses. Layers up to 60 micrometers thick were produced in a work program aimed at producing covers 150 micrometers thick. The mechanical properties of stress, resistance to thermal shock, and adhesion were examined with good results. It is shown that the stress in the covers may be reduced by annealing. The usual methods of calculating film stress are shown to involve unjustified approximations, resulting in error. The error is positive and increases with film thickness. The mean value of the film stress calculated from corrected theory is found in practice to be about 2 x 10 to the 8th power dynes cm/sq cm decreasing with an increase in film thickness. This value compares favorably with 3.5 x 10 to the 9th power cm/sq cm which is the quoted fracture strength of the silicon substrate. The major practical problem is a severe brown coloration which occurs when either the Corning 7740 or the Schott 8330 glass is sputtered. The origins of this coloration which is partly removed by annealing are discussed. Author (ESRO)

N72-14037# Foote Mineral Co., Exton, Pa.
ACTIVE ENERGY STORAGE MATERIALS FOR INTEGRATED CELL STACKS Final Report, 1 Jul. 1970 - 30 Jun. 1971
John H. Fishwick and W. C. T. Yeh Aug. 1971 48 p refs
(Contract DAAB07-70-C-0173; DA Proj. 1T6-62705-A-053)
(AD-728839; ECOM-0173-F; OSD-1366) Avail: NTIS CSCL 10/3

The objective of the program was to develop suitable inorganic separator materials capable of continuous and protracted operation in contact with molten lithium metal and a fused LiCl-KCl eutectic. The report describes the preparation and properties of seven materials based on the cations Li and Ca, and aluminate and zirconate anions. It also describes the manufacture of test pieces from the seven materials and the results of their compatibility testing in lithium metal and lithium chloride-potassium chloride eutectic at elevated temperatures. The most promising material of the seven tested was calcium zirconate. It exhibited good resistance to lithium metal and lithium chloride-potassium chloride eutectic up to nearly 600C. The manufacture of cups of various porosities made from calcium zirconate is also described, and their conductivities in the eutectic are given. An extensive bibliography is included.
Author (GRA)

N72-14038# American Univ., Washington, D.C.
RESEARCH ON ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS Semiannual Report, May - Nov. 1970
Robert T. Foley, Daryl H. Bomkamp, and Charles D. Thompson Jul. 1971 54 p refs
(Contract DA-44-009-AMC-1386(T))
(AD-729923; SAR-10) Avail: NTIS CSCL 07/4

The investigation of electrochemical energy conversion systems has involved work on two tasks. The electrochemical reduction of benzofuroxan in aqueous solutions at pH 6.5 has been investigated. Constant potential reductions at -0.10 and -0.40 v (SCE) were made and dropping mercury polarograms run periodically during the course of the reduction. An insoluble precipitate was observed and repeated reductions were followed by isolation of the product. Preliminary work indicates the product to be 2,3-diaminophenazine. An analysis was made of the rate equation for a steady state reaction which is subject to combined mass transfer and charge transfer control. By considering the overall reaction to be comprised of three consecutive reversible steps in which the rate constants of each step are potential dependent, the usual current-overpotential relationship was derived. Derivation of this relationship by concept of a diffusion activation energy for the reactant and the product species diffusion step and shows that a limiting current arises without having been specifically considered.
Author (GRA)

N72-14039# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF PLANAR PIN THERMOPHOTOVOLTAIC CELLS Annual Report, Jun. 1970 - May 1971
Richard J. Schwartz Aug. 1971 155 p
(Contract DAAB07-70-C-0129; DA Proj. 1T0-61102-A-34-A)
(AD-730771; ECOM-0129-1; AR-1; Task-02; Subtask-312)
Avail: NTIS CSCL 10/2

The results of calculations of the performance of a planar PIN thermophotovoltaic cell are reported. A computer program has been written which allows the computation of the current-voltage characteristics of such a cell. The program allows the cell geometry, the bulk recombination rate, the mobility, the surface recombination velocity, and the input spectrum to be arbitrarily chosen. In addition to the current-voltage characteristic, the maximum operating efficiency and the internal voltage drop are computed. Optimum device dimensions are calculated for a specific set of materials parameters. The device performance is shown to be relatively insensitive to small variations in device dimensions. Experimental work leading to the fabrication of an interdigitated, planar PIN TPV cell is described. Author (GRA)

N72-14040# Pratt and Whitney Aircraft, East Hartford, Conn.
A 1.5 KW FUEL CELL POWERPLANT Final Report, 1 Jul. 1970 - 30 Jun. 1971
Thomas G. Schiller and Alfred P. Meyer Jun. 1971 163 p
(Contract DAAK02-70-C-0158; Contract DA Proj.1-G-663702-DG-1003)
(AD-730796; PWA-4210) Avail: NTIS CSCL 10/2

A 1.5 KW fuel cell powerplant was designed for field power supply. The design was validated by testing a breadboard powerplant incorporating the features of the design. It operates automatically on military logistic fuels over a 0-1.65 KW output power range. The powerplant consists of a dual bed regenerative thermal cracker, an air-cooled phosphoric acid fuel cell subsystem, a solid state voltage regulator, and an automatic control unit. The design is validated by 153 hours of operation of a functionally identical breadboard powerplant. An analysis was conducted to determine the potential of the powerplant.
Author (GRA)

N72-14041# Tyco Labs., Inc., Waltham, Mass.
MOLECULAR ENGINEERING OF PT-BASED ELECTRO-CATALYSTS FOR HYDROCARBON FUEL CELL ELECTRODES Final Technical Report, 1 Nov. 1966 - 31 Jan. 1971
J. Giner, J. M. Parry, C. Leung, S. M. Smith, and M. Turcham Feb. 1971 92 p refs
(Contract DAAE15-67-C-0048; Proj. 1T6-62705-A-01-2-02-026)
(AD-730943; TR-8) Avail: NTIS CSCL 10/2

The program was concerned with relating the activity of platinum black catalysts for the anodic oxidation of propane in 85% H3PO4 at 150C to their physical characteristics. The first phase consisted of the controlled preparation of Pt catalysts with a wide range of activity and in defining the methods of physical characterization. Emphasis was placed on the formaldehyde reduction bf chloroplatinic acid. The preparative method for a Pt black of high activity is presented in detail. One novel technique involving the measurement of the extent of N2 chemisorption on the catalyst was used to assess the role of active sites in the anodic oxidation of hydrocarbons. The catalysts were tested as PTFE bonded electrodes. GRA

N72-14042# Battelle Memorial Inst., Columbus, Ohio.
FAILURE MECHANISMS AND ACCELERATED LIFE TESTS OF NICKEL-CADMIUM BATTERIES Annual Technical Report, No. 2, 1 May 1970 - 30 Apr. 1971
John McCallum and Gerald H. Miller (Air Force Systems Command, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio AFAPL Sep. 1971 101 p refs
(Contract F33615-69-C-1537; AF Proj. 3145)
(AD-730345; AFAPL-TR-70-44-2; Task-314522) Avail: NTIS CSCL 10/2

The report covers research results of the second year of a 3-year program to develop accelerated-life testing procedures for sealed spacecraft cells and batteries. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-14043*# Sandia Labs., Albuquerque, N.Mex. Planetary Quarantine Applied Science Div.
A STUDY OF THE DRY HEAT RESISTANCE OF NATURALLY OCCURRING ORGANISMS WIDELY DISPERSED ON A SURFACE
Daniel M. Garst and Kermit F. Lindell Dec. 1971 18 p refs
(NASA Order W-12853)
(NASA-CR-124832; SC-RR-71-0742) Avail: NTIS CSCL 06M

Although Bacillus subtilis var. niger is the standard test organism for NASA planetary quarantine sterilization studies, it was found that some naturally occurring soil organisms are more heat resistant. The separation of these organisms from soil particles is described. Experiments are discussed which were designed to show that the heat resistance is a natural characteristic of the organisms, rather than a condition induced by the clumping effect of agglomerated particles and organisms. Author

N72-14044*# Martin Marietta Corp., Denver, Colo. Aerospace Group.
EXPERIMENTAL SYSTEM FOR THE CONTROL OF SURGICALLY INDUCED INFECTIONS, OPERATING AND MAINTENANCE INSTRUCTIONS D203613-004
Marvin D. Tevebaugh 13 Oct. 1971 34 p
(Contract NASw-2210)
(NASA-CR-125097; MCR-71-326) Avail: NTIS CSCL 06E

An experimental portable system used to control surgically induced infections is described. The system consists of a portable clean room comprised of a laminar flow filter system consistent with Federal standards; a helmet-shoulder pad assembly; a communication system; a helmet ventilation system; a transparent walled enclosure; and surgical gowns. Guidelines for the set up and operation of such equipment are given along with corrective steps to use in case of system malfunctions. Cleaning procedures, maintenance requirements, and disassembly and transfer particulars are included. E.H.W.

N72-14045# Joint Publications Research Service, Washington, D.C.
BIOPHYSICAL EXPLANATIONS OF THE EFFECT OF MAGNETIC FIELDS ON BIOLOGICAL OBJECTS
I. L. Degen 7 Jan. 1972 15 p refs Transl. into ENGLISH from Vestn. Akad. Nauk Ukr. SSR (Kiev), no. 9, 1971 p 27-34
(JPRS-54880) Avail: NTIS

A review is presented of biological experiments on the effects of a magnetic field on various physiological components. In particular, its effects on blood, cells, and ribonucleic acids are noted. K.P.D.

N72-14046*# Western Michigan Univ., Kalamazoo.
SCHEDULE-INDEPENDENT FACTORS CONTRIBUTING TO SCHEDULE-INDUCED PHENOMENA
R. R. Hutchinson and G. S. Emley Apr. 1970 39 p refs Prepared in cooperation with Fort Custer State Home
(Grants NGR-23-014-001; NGR-23-010-004; NSF GB-18413; Contract N00014-70-A-0183)
(NASA-CR-119248; AD-728436) Avail: NTIS CSCL 05J

Research in comparing the contingent and the noncontingent application of biologically-relevant, or primary reinforcer type, events is reported. A squirrel monkey was restrained in a special chair permitting relative freedom of the torso, upper extremities, and head, while severely restricting the general mobility of the animal, and particularly the tail. The monkey was subjected to painful electric shock by electrodes in contact with his tail, and the response was basically measured in terms of manipulative responses and biting a rubber hose suspended in front of the subject's face, or the biting attack behavior. Unconditional effects, conditional effects, and differential influences of stimuli upon different response classes were studied, along with some differential effects of several drugs upon different response classes. Among the findings is that a progressive increase in some aspect of conditional stimulation results in a general progressively heightened tendency toward action until, at maximal levels, a major inversion to suppression occurs. N.E.N.

N72-14047*# Battelle-Northwest, Richland, Wash.
THE MEASUREMENT OF RADIATION EXPOSURE OF ASTRONAUTS BY RADIOCHEMICAL TECHNIQUES
R. L. Brodzinsai [1970] 8 p refs Sponsored in part by NASA
(Contract AT(45-1)-1830)
(BNWL-SA-3608; NASA-CR-125100) Avail: NTIS CSCL 06R

The principal gamma-ray-omitting radioisotopes produced in the body of astronauts by cosmic-ray bombardment which have half-lives long enough to be useful for radiation dose evaluation are Be-7, Na-22, and Na-24. The sodium isotopes were measured in the preflight and postflight urine and feces, and those feces specimens collected during the manned Apollo missions, by analysis of the urine salts and the raw feces in large crystal multidimensional gamma-ray spectrometers. The Be-7 was chemically separated, and its concentration measured in an all Na(T1), anticoincidence shielded, scintillation well crystal. The overall sensitivity of the experiment was reduced by almost all variables such as low concentrations of excreted cosmogenic radionuclides, high concentrations of injected radionuclides, low sample sizes, long delay periods before analysis, and uncertain excretion rates. The astronaut radiation dose in millirads, as determined by this technique, for the Apollo 7, 8, 9, 10, 11, 12, and 13 missions was 330, 160, <315, 870 $\pm$ 550, 31, 110, and <250 respectively. In view of these limitations this

technique would be best applied to cases of unusually high exposures, such as that encountered from solar flares. Author

N72-14048# Air Force Cambridge Research Labs., Bedford, Mass.
VISUAL SENSATIONS INDUCED BY RELATIVISTIC MUONS
P. J. McNulty Jul. 1971 14 p refs
(AF Proj. 8600-08-01)
(AD-729449; AFCRL-71-0377; AFCRL-ERP-361; DoD-Element-61102F; DoD-Subelement-681300) Avail: NTIS CSCL 20/8

Light flashes induced by the passage of a pulse of extremely relativistic muons were recently observed in an experiment at the Brookhaven A.G.S. The flashes are similar to the bright diffuse lightning behind the cloud type of phosphene described by astronauts. Arguments are presented to show that the probable mechanism of these flashes is Cerenkov radiation. Author (GRA)

N72-14049# Defense Documentation Center, Alexandria, Va.
ENVIRONMENTAL POLLUTION. NOISE POLLUTION; NOISE EFFECTS ON HUMAN PERFORMANCE, VOLUME 1 Bibliography Report, May 1947 - Oct. 1969
Aug. 1971 102 p refs
(AD-729850; DDC-TAS-71-31-1-Vol-1) Avail: NTIS CSCL 06/19

This is Volume I of two volumes on Environmental Pollution: Noise Pollution - Noise Effects on Human Performance in a series of annotated bibliographies on Environmental Pollution. Noise effects on humans such as motor reactions, hearing, speech, sleep, perception, nervous system, visual signals and fatigue are presented. Corporate Author-Monitoring Agency, Subject, Title, and Report Number indexes are included. Author (GRA)

N72-14050# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
BIBLIOGRAPHY OF RESEARCH REPORTS AND PUBLICATIONS ISSUED BY THE BIODYNAMICS AND BIONICS DIVISION, 1963 - 1970
Richard J. Zember, ed. Oct. 1970 49 p refs
(AF Proj. 7231; AF Proj. 7232; AF Proj. 7233)
(AD-729859) Avail: NTIS CSCL 06/19

Publications resulting from the research activities of the Biodynamics and Bionics Division of the Aerospace Medical Research Laboratory are listed for the time period from 1963-1970. The bibliography is divided into six technical areas: Biodynamics (General data, theories, multistress); Bioacoustics (Effects of noise on man and communities); Vibration (Pathological, physiological and performance effects; protection); Impact (Human tolerance, protection); Bionics/Biocybernetics (Neurophysiology, Theoretical Biology, Models of biological capabilities, pattern recognition, etc.); Miscellaneous (Instrumentation, computer programs, etc.). Author (GRA)

N72-14051# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 25, NO. 7
John G. Foss and Victoria S. Hewitson 31 Jul. 1971 42 p refs
(AD-729288) Avail: NTIS CSCL 14/2

The monthly publication presents brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. Author (GRA)

N72-14052# Bunker-Ramo Corp., Westlake Village, Calif.
DEVELOPMENT OF A HUMAN PERFORMANCE RELIABILITY DATA SYSTEM
David Meister and Robert G. Mills (AMRL) Wright-Patterson AFB, Ohio AMRL Jun. 1971 20 p refs Presented at the Reliability and Maintainability Conf., 10th, held 28-30 Jun. 1971 Based on final rept. on contract cited
(Contract F33615-70-C-1518; AF Proj. 7184)
(AD-730910; AMRL-TR-71-74; Task-718409) Avail: NTIS CSCL 05/10

A study was performed to determine the requirements for and the elements of a human performance reliability (HPR) data system. The heart of the HPR system is a taxonomic structure for classifying behavioral studies. 140 studies from a variety of sources were coded using this taxonomy. To test the efficiency of this data bank to provide answers to system development questions a number of tests were performed to determine the relevance of the data retrieved to the questions asked. The results of these tests indicated that it is possible to expand the HPR data base provided one is not restircted to a probabilistic metric. Author (GRA)

N72-14056*# Texas Womens Univ. Research Inst., Denton.
BONE DEMINERALIZATION
Pauline B. Mack, George P. Vose, Fred B. Vogt (Tex. Inst. for Rehabil. and Res.), and Paul A. LaChance (NASA. Manned Spacecraft Center, Houston, Tex.) *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 45-85 refs (See N72-14053 05-05)
(Expt-M006) Avail: NTIS CSCL 06S

N72-14057*# National Institutes of Health, Bethesda, Md.
CALCIUM AND NITROGEN BALANCE, EXPERIMENT M007
G. Donald Whedon, Leo Lutwak (Cornell Univ., Ithaca, N. Y.), William F. Neuman (Rochester Univ., N. Y.), and Paul A. LaChance (NASA. Manned Spacecraft Center, Houston, Tex.) *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 87-110 refs (See N72-14053 05-05)
(Expt-M007) Avail: NTIS CSCL 06S

N72-14061*# Naval School of Aviation Medicine, Pensacola, Fla.
HUMAN OTOLITH FUNCTION, EXPERIMENT M009
Ashton Graybiel and Earl F. Miller, II *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 155-170 refs (See N72-14053 05-05)
(Expt-M009) Avail: NTIS CSCL 06P

N72-14063*# Oak Ridge National Lab., Tenn.
RADIATION AND ZERO-GRAVITY EFFECTS ON HUMAN LEUKOCYTES AND NEUROSPORA CRASSA
Michael A. Bender, F. J. DeSerres, P. Carolyn Gooch, I. R. Miller, D. B. Smith, and Sohei Kondo *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 205-235 refs (See N72-14053 05-05)
(Expt-S004) Avail: NTIS CSCL 06S

N72-14064*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FROG EGG GROWTH, EXPERIMENT S003
Richard S. Young and J. W. Tremor *In its* The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 237-244 (See N72-14053 05-05)
(Expt-S003) Avail: NTIS CSCL 06C

N72-14065*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEA URCHIN EGG FERTILIZATION AND DEVELOPMENT
Richard S. Young *In its* The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 245-247 (See N72-14053 05-05)
(Expt-S002) Avail: NTIS CSCL 06C

N72-14068# Joint Publications Research Service, Washington, D.C.
ROLE OF VISCERAL AFFERENTATION IN VESTIBULAR SYSTEM ACTIVITY
V. S. Raytses and A. M. Dutov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 9-17 refs (See N72-14066 05-05)
Avail: NTIS

N72-14069# Joint Publications Research Service, Washington, D.C.
EFFECT OF HYPOXIA ON THE DIURNAL RHYTHM OF MITOTIC ACTIVITY IN THE BONE MARROW ERYTHROPOIETIC SYSTEM
S. Baranski, K. Kwarezki, Ya. Rozinski, and S. Smigelski *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 18-22 refs (See N72-14066 05-05)
Avail: NTIS

N72-14071# Joint Publications Research Service, Washington, D.C.
EFFECT OF DIFFERENT ATMOSPHERES ON ACTIVE TRANSPORT OF GLUCOSE IN THE SMALL INTESTINE OF RATS
O. I. Babkina and K. V. Smirnov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 30-36 refs (See N72-14066 05-05)
Avail: NTIS

N72-14072# Joint Publications Research Service, Washington, D.C.
EFFECT OF HYPOKINESIA ON THE HYPOTHALAMIC HYPOPHYSEAL NEUROSECRETORY SYSTEM IN RATS
L. A. Andrianova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 37-41 refs (See N72-14066 05-05)
Avail: NTIS

N72-14073# Joint Publications Research Service, Washington, D.C.
MATHEMATICAL DESCRIPTION OF RADIATION DAMAGE AND RECOVERY PROCESSES IN THE HEMOPOIETIC SYSTEM
R. A. Kuzin, G. F. Nevskaya, V. I. Popov, V. A. Sakovich, A. V. Shafirkin, and V. V. Yurgov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 42-47 refs (See N72-14066 05-05)
Avail: NTIS

N72-14074# Joint Publications Research Service, Washington, D.C.
EFFECT OF ATP DURING PROLONGED IRRADIATION
V. D. Rogozkin, M. V. Tikhomirova, and L. M. Ostroumova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 48-53 refs (See N72-14066 05-05)
Avail: NTIS

N72-14077# Joint Publications Research Service, Washington, D.C.
DURATION OF THE DAILY CYCLE ANALYZED WITH RESPECT TO ITS INFORMATION ENERGY COST
S. I. Stepanova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 67-76 refs (See N72-14066 05-05)
Avail: NTIS

N72-14085# Joint Publications Research Service, Washington, D.C.
POSSIBILITY OF THE DEVELOPMENT OF DYSBACTERIOSIS IN GUINEA PIGS AND RATS UNDER THE INFLUENCE OF A MAGNETIC FIELD
V. M. Katola and A. N. Kovalevskaya *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 125-127 refs (See N72-14066 05-05)
Avail: NTIS

N72-14086# Joint Publications Research Service, Washington, D.C.
INTENSITY OF TISSUE AUTOLYSIS IN ANIMALS DURING HYPOKINESIA
I. V. Fedorov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 128-130 refs (See N72-14066 05-05)
Avail: NTIS

N72-14087# Joint Publications Research Service, Washington, D.C.
EFFECT OF ILLUMINATION ON THE RADIATION EFFECT IN LEAF CABBAGE AFTER IRRADIATION BY PROTONS AND GAMMA RAYS
I. S. Skukina, Yu. I. Shaydorov, and V. N. Nekrasova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 131-136 refs (See N72-14066 05-05)
Avail: NTIS

N72-14088# Joint Publications Research Service, Washington, D.C.
SOPORIFIC AND TOXIC EFFECT OF AMOBARBITAL SODIUM DURING 33-DAY HYPOKINESIA AND ISOLATION OF MICE
L. A. Kravchuk *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 137-140 refs (See N72-14066 05-05)
Avail: NTIS

N72-14089# Joint Publications Research Service, Washington, D.C.
EFFECT EXERTED ON ERYTHROPOIESIS IN FISH AND RATS BY WATER REGENERATED FROM HUMAN URINE
L. A. Telitchenko and M. M. Boychenko *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 141-142 refs (See N72-14066 05-05)
Avail: NTIS

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-14053*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM BIOMEDICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler and Thomas G. Rogers, comps. (ITT Federal Elec. Corp., Houston, Tex.) Sep. 1971 256 p refs
(NASA-TM-X-58074) Avail: NTIS CSCL 05E

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3. CARDIOVASCULAR CONDITIONING, EXPERIMENT M001 L. F. Dietlein and W. V. Judy p 3-30 refs (See N72-14054 05-05)
4. INFLIGHT PHONOCARDIOGRAM, EXPERIMENT M004 L. F. Dietlein p 31-44 refs (See N72-14055 05-05)
5. BONE DEMINERALIZATION P. B. Mach, G. P. Vose (Tex. Woman's Univ.), F. B. Vogt (Tex. Inst. for Rehabil. and Res.), and P. A. LaChance p 45-85 refs (See N72-14056

05-04)

6. CALCIUM AND NITROGEN BALANCE, EXPERIMENT M007 G. D. Whedon (Natl. Inst. of Health), L. Lutwak (Cornell Univ., Ithaca, N.Y.), W. F. Neuman (Rochester Univ., N.Y.), and P. A. LaChance p 87-110 refs (See N72-14057 05-04)

7. INFLIGHT EXERCISE AND WORK TOLERANCE, EXPERIMENT M003 L. F. Dietlein and R. M. Rapp p 111-124 refs (See N72-14058 05-05)

8. BIOASSAY OF BODY FLUID, EXPERIMENT M005 L. F. Dietlein and E. S. Harris p 125-145 refs (See N72-14059 05-05)

9. ANALYSIS OF INFLIGHT SLEEP, EXPERIMENT M008 P. Kellaway (Baylor Univ., Houston, Tex.) p 147-154 (See N72-14060 05-05)

10. HUMAN OTOLITH FUNCTION, EXPERIMENT M009 A. Graybiel and E. F. Miller II (Naval School of Aviation Medicine) p 155-170 refs (See N72-14061 05-04)

11. VISUAL ACUITY AND VISIBILITY, EXPERIMENTS S008 AND D013 S. Q. Duntley, R. W. Austin, J. H. Taylor, and J. L. Harris (Calif. Univ., San Diego) p 171-203 refs (See N72-14062 05-05)

12. RADIATION AND ZERO-GRAVITY EFFECTS ON HUMAN LEUKOCYTES AND NEUROSPORA CRASSA M. A. Bender, F. J. de Serres, P. C. Gooch, I. R. Miller, D. B. Smith, and S. Kondo (Oak Ridge Natl. Lab.) p 205-235 refs (See N72-14063 05-04)

13. FROG EGG GROWTH, EXPERIMENT S003 R. S. Young and J. W. Tremor (NASA. Ames Res. Center, Moffett Field, Calif.) p 237-244 refs (See N72-14064 05-04)

14. SEA URCHIN EGG FERTILIZATION AND DEVELOPMENT R. S. Young (NASA. Ames Res. Center, Moffett Field, Calif.) p 245-247 (See N72-14065 05-04)

N72-14054*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

CARDIOVASCULAR CONDITIONING, EXPERIMENT M001

Lawrence F. Dietlein and William V. Judy *In its* The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 3-30 refs (See N72-14053 05-05)

(Expt-M001) Avail: NTIS CSCL 05E

Based on preflight and postflight data, it is concluded that pulsatile cuffs are not effective in lessening postflight orthostatic intolerance. This conclusion is based on the higher heart rates observed during subsequent tilts. It is well established that syncope itself is a poor indicator of the extent of cardiovascular deconditioning. Pulsatile cuffs did lessen the extent of postflight pooling of blood in the legs of test subjects (as determined by the strain-gauge technique). Author

N72-14055*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

INFLIGHT PHONOCARDIOGRAM, EXPERIMENT M004

Lawrence F. Dietlein *In its* The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 31-44 refs (See N72-14053 05-05)

(Expt-M004) Avail: NTIS CSCL 06B

Electrocardiographic and phonocardiographic data were obtained from both the Gemini 4 and 5 crewmembers. The objective of Experiment M004 was the measurement and correlation of the various phases of the electrical and mechanical activity of the cardiac cycle, in an effort to gain insight into the cardiac functional status of crewmembers during long-duration space flight. Author

N72-14056*# Texas Womens Univ. Research Inst., Denton.

BONE DEMINERALIZATION **c04**

Pauline B. Mack, George P. Vose, Fred B. Vogt (Tex. Inst. for Rehabil. and Res.), and Paul A. LaChance (NASA. Manned Spacecraft Center, Houston, Tex.) *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 45-85 refs (See N72-14053 05-05)

(Expt-M006) Avail: NTIS CSCL 06S

Crew members of the Gemini 4, Gemini 5, and Gemini 7 missions were compared regarding skeletal changes in three major anatomic sites with respect to changes in skeletal density during space flight. Bone-mass changes have been found for the command pilot and the pilot of each mission in the conventional os calcis section, in the combined sections covering 60 percent of the os calcis, and in hand phalanges 5-2 and 4-2. Comparison of radiographically determined losses in X-ray absorbence with X-ray absorbence losses in healthy young men subjected to bedrest immobilization for the same length of time showed that losses for the crewmembers exceeded losses for the bedrest subjects in all cases; this was an indiciation that restriction of body movement did not represent the only factor involved. Author

N72-14057*# National Institutes of Health, Bethesda, Md.

CALCIUM AND NITROGEN BALANCE, EXPERIMENT M007 **c04**

G. Donald Whedon, Leo Lutwak (Cornell Univ., Ithaca, N. Y.), William F. Neuman (Rochester Univ., N. Y.), and Paul A. LaChance (NASA. Manned Spacecraft Center, Houston, Tex.) *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 87-110 refs (See N72-14053 05-05)

(Expt-M007) Avail: NTIS CSCL 06S

The collection of data on the response of the skeletal and muscular systems to 14-day space flights was evaluated for loss of calcium, nitrogen, and other metabolically related elements. Considerable interindividual variability was demonstrated in all experimental factors that were measured. Calcium balance became less positive and urinary phosphate excretion increased substantially in flight despite a reduction in phosphate intake. Patterns of excretion of magnesium, sodium, potassium, and chloride were different for each subject, and, in part, could be correlated with changes in adrenocortical steroid production. The principal hormonal change was a striking decrease during flight in the urinary excretion of 17-hydroxycortocosteroids. Dermal losses of calcium, magnesium, sulfate, and phosphate were insignificant during all three phases. Author

N72-14058*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

INFLIGHT EXERCISE AND WORK TOLERANCE, EXPERIMENT M003

Lawrence F. Dietlein and Rita M. Rapp *In its* The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 111-124 refs (See N72-14053 05-05)

(Expt-M003) Avail: NTIS CSCL 05E

The response of the cardiovascular system to a known exercise workload is used as index of the general physical condition of crewmembers during long duration space flight. Day-to-day evaluations of pulse rates before and after exercise periods were not remarkable. The response of the cardiovascular system to a calibrated workload was relatively constant for a given individual during space flights of as many as 14 days in connection with the Gemini Program. Author

N72-14059*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

BIOASSAY OF BODY FLUIDS, EXPERIMENT M005

Lawrence F. Dietlein and Elliott S. Harris *In its* The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 125-145 refs (See N72-14053 05-05)

(Expt-M005) Avail: NTIS CSCL 06S

Preflight and postflight urine and plasma samples from the Gemini 7 and Gemini 9 crewmembers were analyzed. Electrolyte and water retention observed immediately postflight was consistent with the assumption that the Gauer-Henry atrial reflex was responsive to a change from the weightless to the unit-gravity environment. Immediately postflight, plasma 17-hydroxycorticosteroid concentrations were increased and plasma uric acid concentration was decreased. The increased excretion of 17-hydroxycorticosteroids immediately postflight probably was caused by the stress of entry. The postflight increase of plasma protein, and the slightly smaller increase of

plasma electrolytes postflight, was consistent with an inflight water and electrolyte loss that resulted in postflight retention of water and electrolytes. Author

N72-14060*# Baylor Univ., Houston, Tex. Coll. of Med.
ANALYSIS OF INFLIGHT SLEEP, EXPERIMENT M008
Peter Kellaway *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 147-154 (See N72-14053 05-05)
(Expt-M008) Avail: NTIS CSCL 05E

The feasibility of recording the electroencephalogram during space flight is demonstrated. The precise information that is collected with the electroencephalograph regarding the duration, depth, and number of sleep periods implies that electroencephalogram monitoring should be considered for routine use in the long-duration space flights that are contemplated for the Apollo Program and other programs. The importance of such information in the direction and execution of the flight, both to the medical monitors and to the crewmembers, is obvious. Author

N72-14061*# Naval School of Aviation Medicine, Pensacola, Fla.
HUMAN OTOLITH FUNCTION, EXPERIMENT M009 c04
Ashton Graybiel and Earl F. Miller, II *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 155-170 refs (See N72-14053 05-05)
(Expt-M009) Avail: NTIS CSCL 06P

The experiments that were performed during the Gemini 5 and 7 missions resulted in quantitative information concerning otolithic function and orientation of four subjects exposed to an orbiting spacecraft environment for prolonged periods of time. Preflight counterrolling measurements revealed significant differences between crewmembers with regard to the basic magnitude of otolith response. However, after the flight, each crewmember maintained his respective preflight level of response. This was indicative that no significant change in otolithic sensitivity occurred as a result of the flight, or at least no change persisted long enough to be recorded several hours after recovery. The EVLH data recorded for each subject confirmed the observation that a coordinate space sense exists even in a weightless environment if contact cues are adequate. However, it was noted that the apparent location of the horizontal within the spacecraft may not agree necessarily with its physical correlate in the spacecraft. Author

N72-14062*# California Univ., San Diego. Scripps Inst. of Oceanography.
VISUAL ACUITY AND VISIBILITY, EXPERIMENTS S008 AND D013
Seibert Q. Duntley, Roswell W. Austin, John H. Taylor, and James L. Harris *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 171-203 refs (See N72-14053 05-05)
(Expt-S008; Expt-D013) Avail: NTIS CSCL 05E

Data from the inflight vision tester showed that no change was detected in the visual performance of any of the four crewmembers of the Gemini 5 and 7 missions. Results from observations of the side near Laredo, Texas, confirmed that the visual performance of the crewmen during space flight was within the statistical range of their preflight visual performance. The results also demonstrated that visual data collected in the laboratory can be combined with environmental optical data to predict correctly the limiting visual capability of humans to discriminate small objects on the surface of the earth in daylight. Author

N72-14063*# Oak Ridge National Lab., Tenn.
RADIATION AND ZERO-GRAVITY EFFECTS ON HUMAN LEUKOCYTES AND NEUROSPORA CRASSA c04
Michael A. Bender, F. J. DeSerres, P. Carolyn Gooch, I. R. Miller, D. B. Smith, and Sohei Kondo *In* NASA. Manned Spacecraft Center The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 205-235 refs (See N72-14053 05-05)
(Expt-S004) Avail: NTIS CSCL 06S

The two parts of this experiment have resulted in proof that neither orbital space flight nor any of the stresses connected with it produced significant, unpredicted genetic damage, at least insofar as chromosomal-aberration production is a valid measure of this general type of effect. Furthermore, the Gemini 11 results lead to the conclusion that no synergistic effect exists between radiation and factors that are associated with space flight. No significant difference was found between dose-effect curves for survival or mutation induction of the inflight and ground-based samples irradiated on filters. Thus, like the blood experiment, this part of the experiment failed to result in data that were appropriate for confirmation of the apparent synergism that was observed in the Gemini 3 blood experiment. Also, the Nuerospora crassa experiment provided conclusive data that there is no difference in the genetic effects of irradiation during space flight and the genetic effects obtained in ground-based experiments. Both the Gemini 11 blood experiment and the Neurospora crassa experiment thus have failed to result in data confirmatory of the apparent synergism observed on the Gemini 3 mission. Author

N72-14064*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FROG EGG GROWTH, EXPERIMENT S003 c04
Richard S. Young and J. W. Tremor *In its* The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 237-244 (See N72-14053 05-05)
(Expt-S003) Avail: NTIS CSCL 06C

The objective of experiment was to determine the effect of weightlessness on the ability of a fertilized frog egg to divide normally and to differentiate and form a normal embryo. This experiment was first attempted on the Gemini 8 mission and was completed only partially because of the early termination of that mission. Author

N72-14065*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEA URCHIN EGG FERTILIZATION AND DEVELOPMENT c04
Richard S. Young *In its* The Gemini Program Biomed. Sci. Expt. Sum. Sep. 1971 p 245-247 (See N72-14053 05-05)
(Expt-S002) Avail: NTIS CSCL 06C

The effects of subgravity (much less than unit gravity) on fertilization, cell division, differentiation, and growth of a relatively simple biological system (eggs of the sea urchin Arbacia punctulata) were considered. The experiment was flown on Gemini 3 and recovered as scheduled. However, the experiment objectives were not achieved, primarily for mechanical reasons. Author

N72-14066# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 5, NO. 5, 1971
O. G. Gazenko, ed. 22 Dec. 1971 147 p refs Transl. into ENGLISH of Kosmicheskaya Biol. Med., Med. Publishing House, Moscow, v. 5, no. 5, 1971 p 3-90
(JPRS-54768) Avail: NTIS

Aerospace medical and exobiological factors of manned space flight are considered. The effects of physiological and psychological stresses, confining life support systems, radiation exposures, and regenerated breathing atmospheres on the human body are accentuated. For individual titles, see N72-14067 through N72-14089.

N72-14067# Joint Publications Research Service, Washington, D.C.
RESCUE OF SPACECRAFT CREWS AFTER THEIR FORCED LANDING ON LAND OR AT SEA
V. G. Volovich and M. A. Tumanov *In its* Space Biol. and Med.,

vol. 5, no. 5, 1971 22 Dec. 1971 p 1-8 refs (See N72-14066 05-05)
Avail: NTIS

Environmental factors acting on the human body are considered in the rescue of spacecraft crews after emergency landings on land or at sea. Regions with external climatic-meteorological conditions under which man's self-sustaining existence is particularly complex are: deserts, tropical zones of the oceans, and arctic areas. Consolidated portable emergency supplies consist of food rations, water, equipment for distilling and storing water, radio and signaling devices, pharmaceuticals, boat or raft, personal necessities, and camping equipment if feasible. The greatest emphasis is placed on search facilities for rescuing crews and the timely discovery, medical treatment, and evacuation of those flying crews after emergency landings. G.G.

N72-14068# Joint Publications Research Service, Washington, D.C.
ROLE OF VISCERAL AFFERENTATION IN VESTIBULAR SYSTEM ACTIVITY **c04**
V. S. Raytses and A. M. Dutov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 9-17 refs (See N72-14066 05-05)
Avail: NTIS

Chronic experiments were performed on rabbits to study the effect of stimulating gastric and rectal mechanoreceptors on postural-tonic and vestibular-oculomotor reflexes of the labyrinth evoked in response to vestibular excitation. Visceral irritation of moderate intensity decreased the vestibular apparatus stimulation threshold, increased the reflex time, and shifted the maximum of muscular discharges toward weaker labyrinthal stimulation. They also increased the frequency and amplitude of rotational and post-rotational nystagmus, thus indicating an increase in vestibular excitability under these circumstances. The mentioned parameters of postural-tonic and vestibular-oculomotor reflexes declined in response to relatively weak visceral stimulation. Author

N72-14069# Joint Publications Research Service, Washington, D.C.
EFFECT OF HYPOXIA ON THE DIURNAL RHYTHM OF MITOTIC ACTIVITY IN THE BONE MARROW ERYTHROPOIETIC SYSTEM **c04**
S. Baranski, K. Kwarezki, Ya. Rozinski, and S. Smigelski *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 18-22 refs (See N72-14066 05-05)
Avail: NTIS

Experiments performed on guinea pigs under varying illumination conditions and on animals kept for 14 days at an elevation of 7,000 m revealed a distinct relationship between the mitotic activity of bone marrow cell erythropoiesis and the illumination pattern. They also demonstrated hypoxic stimulation of the erythropoietic system. Author

N72-14070# Joint Publications Research Service, Washington, D.C.
REACTION OF THE HUMAN BODY DURING BREATHING OF GAS MIXTURES CONTAINING 3-9% CO2
I. I. Malkiman, V. N. Polyakov, and V. K. Stepanov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 23-29 refs (See N72-14066 05-05)
Avail: NTIS

The toxic effects of carbon dioxide on the human body are investigated by studying the body reactions of humans breathing atmospheres containing from 3 to 9 percent CO2. Evaluations of physiological functions in relation to the CO2 concentration in the inhaled gas mixture show that all subjects easily tolerate 3 to 6 percent of carbon dioxide. Second degree toxic reactions are observed when gas mixtures contain more than 7 percent CO2; this is characterized by stressing of all physiological body functions. However, the degree of poisoning symptoms depends also in individual sensitivity to such an exposure. G.G.

N72-14071# Joint Publications Research Service, Washington, D.C.
EFFECT OF DIFFERENT ATMOSPHERES ON ACTIVE TRANSPORT OF GLUCOSE IN THE SMALL INTESTINE OF RATS **c04**
O. I. Babkina and K. V. Smirnov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 30-36 refs (See N72-14066 05-05)
Avail: NTIS

Experiments conducted with segments of the small intestine in rats gave evidence that a preliminary exposure of the animals to a modified atmosphere (hypoxia-ascent to an altitude of 12,000 m; hypercapnia--20% CO2; hyperoxia--100% O2 at a pressure of 4 atm) accelerated the active transport of glucose. Exposure to a hypoxic atmosphere induced the greatest changes. Author

N72-14072# Joint Publications Research Service, Washington, D.C.
EFFECT OF HYPOKINESIA ON THE HYPOTHALAMIC HYPOPHYSEAL NEUROSECRETORY SYSTEM IN RATS **c04**
L. A. Andrianova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 37-41 refs (See N72-14066 05-05)
Avail: NTIS

Animals exposed to hypokinetic conditions exhibited an activation of the hypothalamic-hypophyseal neurosecretory system at early stages during exposure. The reaction was characterized by release of the neurosecretory substance from the hypophyseal posterior lobe and in increase in the antidiuretic hormone concentration in the blood. Author

N72-14073# Joint Publications Research Service, Washington, D.C.
MATHEMATICAL DESCRIPTION OF RADIATION DAMAGE AND RECOVERY PROCESSES IN THE HEMOPOIETIC SYSTEM **c04**
R. A. Kuzin, G. F. Nevskaya, V. I. Popov, V. A. Sakovich, A. V. Shafirkin, and V. V. Yurgov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 42-47 refs (See N72-14066 05-05)
Avail: NTIS

A mathematical model describing changes in the leukocyte count after total or partial body irradiation is reported. The proposed model makes it possible to take into account irradiation of different organs and the probability of their damage. This model is used in analyzing the results of an experiment in which dogs were irradiated with 250-MeV protons in a dose of 350 rads when partial body shielding was used. The degree of residual damage, recovery rate, and percentage of total bone marrow in different body regions and leukocyte lifetimes were determined. The latter two parameters determined using the proposed model are in good agreement with data calculated by the use of the other methods. Author

N72-14074# Joint Publications Research Service, Washington, D.C.
EFFECT OF ATP DURING PROLONGED IRRADIATION **c04**
V. D. Rogozkin, M. V. Tikhomirova, and L. M. Ostroumova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 48-53 refs (See N72-14066 05-05)
Avail: NTIS

The effect of ATP was studied during prolonged irradiation (0.28 to 1.0 R/min) of mice, guinea pigs and dogs. ATP administration gave the most distinct and positive effect in dogs. ATP administration during prolonged gamma irradiation of dogs with lethal doses increased their survival by 40 percent (in comparison with the control) and alleviated the development of acute radiation damage. Author

N72-14075# Joint Publications Research Service, Washington, D.C.

PRODUCING AND EVALUATING THE EFFECTIVENESS OF SILVERED FILTERS FOR DECONTAMINATING AND PRESERVING WATER

V. V. Shaydorova, S. V. Chizhov, Yu. Ye. Sinyak, A. A. Ballod, and N. A. Sokolova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 54-60 refs (See N72-14066 05-05)
Avail: NTIS

The experimental characteristics are given for the contact method of decontaminating water using silver reduced on the surface of activated charcoals and ion exchange resins using ascorbic acid, hydroquinone and formaldehyde. It was established that the dynamics of dissolving of ionic silver from silvered surface is dependent on the chemical nature of the sorbent and on the method for reducing the silver. In this method the decisive role is played by impurities present on the sorbent surface. A filter consisting of a silvered KU-2 x 8 cationite, reduced by hydroquinone, and AG-5 activated charcoal exhibited a stable rate of washing of silver from the surface. Author

N72-14076# Joint Publications Research Service, Washington, D.C.

TIME DEFICIT AS A STRESS FACTOR IN MENTAL ACTIVITY OF AN OPERATOR IN A MAN FLIGHTCRAFT SYSTEM

K. K. Isoeliani *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 61-66 refs (See N72-14066 05-05)
Avail: NTIS

The mental activity of an operator who experienced a time deficit was studied by observing his sensorimotor activizy in perceiving stimuli in a broad visual field. Determined was the rate limit at which the subject retained a capacity for working at a maximum level. The study was made with 250 healthy male subjects in the age group 25 to 45 years. Subjects were classified into three groups which differed substantially in their rate of mental activity: high, moderate and low. While working at the maximum rate the subjects exhibited unequal neuropsychic stress and uneven performance. When an individual man-operator was engaged in complex and continuous work the time deficit appeared to be a stress factor which made his functioning in the man-flightcraft system more difficult. Author

N72-14077# Joint Publications Research Service, Washington, D.C.

DURATION OF THE DAILY CYCLE ANALYZED WITH RESPECT TO ITS INFORMATION ENERGY COST c04

S. I. Stepanova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 67-76 refs (See N72-14066 05-05)
Avail: NTIS

Stability of the information and energy cost in the human daily (circadian) cycle is analyzed. It is postulated that with any change in the sleep-wakefulness cycle its information and energy cost is invariable. According to this hypothesis a human being cannot adapt to a day shorter than 12 hours or longer than 52 hours. An equation to be used in calculating the optimum duration of the circadian cycle of a particular individual with respect to the energy cost of his working hours is derived. The question of whether it is advisable to change the normal 24-hour cycle during prolonged space missions is considered. Author

N72-14078# Joint Publications Research Service, Washington, D.C.

COMPARISON OF TOLERANCE OF FRONTAL AND SAGITTAL HEAD TILTS IN MAN IN ROTATING SYSTEMS

F. A Solodovnik *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 77-81 refs (See N72-14066 05-05)
Avail: NTIS

The vestibular tolerance of subjects who were rotated with their heads tilted in the sagittal and frontal planes was studied. The chair was rotated at a rate of 180 deg/sec and the subjects tilted their heads every 5 seconds at an angle of 30 deg. The experiments demonstrated that the subjects developed motion sickness much faster when their heads were tilted frontally. A comparison of the directions of inertial displacement of the endolymph in the vertical semicircular canals and and the resultant of linear accelerations gave evidence that the stimulation of the vertical semicircular canals and otoliths differed greatly when the head was tilted sagitally and frontally during rotation. Author

N72-14079# Joint Publications Research Service, Washington, D.C.

FORCES ACTING ON VESTIBULAR APPARATUS RECEPTOR FORMATIONS DURING HEAD MOVEMENTS

V. N. Krutko *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 82-86 refs (See N72-14066 05-05)
Avail: NTIS

On the basis of a mathematical analysis of natural movements of the human head formulas were derived for determining the forces affecting vestibular apparatus receptor formations. It was found that head movements are accompanied by transfer and relative accelerations as well as by Coriolis accelerations. An example of the computation of forces affecting the otoliths and semicircular canals during a stipulated head movement is given. Author

N72-14080# Joint Publications Research Service, Washington, D.C.

IN-FLIGHT ACCELERATION SENSATIONS AND METHODS FOR CONTENDING WITH THEM

Yu. F. Udalov, V. F. Zhernavkov, O. P. Khalatov, and N. A. Chelnokova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 87-96 refs (See N72-14066 05-05)
Avail: NTIS

Post-flight examinations revealed a decrease in the amino acid level, an increase in the intensity of protein metabolism, and a change in pyridoxine metabolism which suggested that its use increased during flight. After flight, vestibular tolerance decreased and the state of the vestibular analyzer changed. It is suggested that the mentioned variations are related to metabolic conditions. This was verified experimentally by inducing pyridoxine deficiency in the body causing disturbed acceleration sensations and inadequate (illusionary) feelings. The changes were eliminated by administering pyridoxal combined with ATP. This drug combination was effective in treating metabolic changes induced by flight effects. Author

N72-14081# Joint Publications Research Service, Washington, D.C.

DEPENDENCE OF THE NATURE OF CRANIOCEREBRAL TRAUMA ON IMPACT CONDITIONS

B. A. Rabinovich, L. N. Shollo, and Ye. Ya. Shcherbakova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 97-105 refs (See N72-14066 05-05)
Avail: NTIS

Case histories of 317 subjects with craniocerebral trauma were examined. Impact parameters were determined from the accident descriptions. With an impact velocity of 3.0 to 10.5 m/sec, the severity of the craniocerebral trauma depended to a considerable degree on the occurrence of fractures in the cranial base and on the degree of pathogenetic involvement of intracranial structures adjacent to the cranial base, including the main carotid vessels. These injuries did not occur when impacts were in the frontal zone and nearly always occurred in the case of impacts in the temporal and occipital regions with a velocity of more than 5.5 m/sec. Author

N72-14082# Joint Publications Research Service, Washington, D.C.

RATE OF ELIMINATION OF METABOLIC PRODUCTS FROM MAN CONFINED IN INSULATING GEAR (FOR DIFFERENT PHYSICAL LOADS AND DIETS)

S. M. Gorodinskiy, A. V. Sedov, A. N. Mazin, G. A. Gaziyev, A. P. Kleptsova, and L. I. Zhukova *In its* Space Biol. and Med., vol. 5,

no. 5, 1971 22 Dec. 1971 p 106-111 refs (See N72-14066 05-05)
Avail: NTIS

Test subjects were given special diets and kept either at rest or performing work at a rate of 200 and 400 Cal/hour in a normal atmosphere. Under these conditions the rate at which they released volatile and gaseous toxic compounds was measured. The subjects who consumed the diets exhibited a significant decrease in the exhalation of hydrogen sulfide, acetone, phenol, ammonia and amines in comparison with subjects who ate as they chose. The diets did not affect the rate of elimination of carbon monoxide and carbon dioxide. Author

N72-14083# Joint Publications Research Service, Washington, D.C.

SYNTHESIS OF REDOX POLYMERS AND THEIR USE FOR PURIFYING AQUEOUS SOLUTIONS FROM ORGANIC IMPURITIES

Ye. Ye. Yergozhin, B. A. Zhubanov, S. R. Rafikov, Yu. Ye Sinyak, V. F. Stolbov, and V. V. Krasnoshchekov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 112-118 refs (See N72-14066 05-05)
Avail: NTIS

The synthesis of polycondensation redox polymers with an ordinary and macroporous structure and a preliminary study of the possibility of their use for purifying aqueous solutions from the organic impurities present in a condensate of atmospheric moisture are reported. It is shown that with an increase in length of the hydrocarbon radical the capacity of the polymer for sorbed compounds increases. Author

N72-14084# Joint Publications Research Service, Washington, D.C.

CATALYTIC OXIDATION OF SOME GASEOUS PRODUCTS OF PYROLYSIS OF WASTES OF HUMAN VITAL FUNCTIONS

G. S. Sinyak, P. V. Lisovskiy, G. I. Chizhikova, M. A. Vitashkina, Ye. I. Karpova, B. G. Gusarov, and L. L. Zablotskiy *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 119-124 refs (See N72-14066 05-05)
Avail: NTIS

A study was made of the applicability of catalysts (hopcalite, copper-chromium, copper-cobalt, platinum and palladium) in bringing about deep oxidation of the vapor-gaseous phase formed during the thermal treatment of human wastes. Oxidizing properties of the catalysts were studied for individual gases: methane, hydrogen, and carbon monoxide. Catalysts with higher activity were used to oxidize a real gas mixture. It was found that the gas mixture oxidation reaction is completed at 350 deg only when using a palladium catalyst. Author

N72-14085# Joint Publications Research Service, Washington, D.C.

POSSIBILITY OF THE DEVELOPMENT OF DYSBACTERIOSIS IN GUINEA PIGS AND RATS UNDER THE INFLUENCE OF A MAGNETIC FIELD **c04**

V. M. Katola and A. N. Kovalevskaya *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 125-127 refs (See N72-14066 05-05)
Avail: NTIS

Prolonged exposure of animals to a magnetic field with a strength of 2,500 oe with a gradient of 23 oe/cm can in some cases lead to the appearance of enteric dysbacteriosis in guinea pigs and rats. A general observation is that an increase in the number of coliform bacteria in the intestine of these species of animals is observed during the second or third week of the experiment. Further exposure in a magnetic field leads to body adaptation in the animals and a normalization of intestinal microflora. Author

N72-14086# Joint Publications Research Service, Washington, D.C.

INTENSITY OF TISSUE AUTOLYSIS IN ANIMALS DURING HYPOKINESIA **c04**

I. V. Fedorov *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 128-130 refs (See N72-14066 05-05)
Avail: NTIS

The total content of free amino acids in the tissues prior to incubation and after 15-22 days of hypolinesia was at the same level as in healthy animals, virtually coinciding even in absolute mean numbers. On the 51st-59th days of hypokinesia the content of free amino acids in all the investigated tissues exhibited a reliable decrease ($P < 0.05$). Author

N72-14087# Joint Publications Research Service, Washington, D.C.

EFFECT OF ILLUMINATION ON THE RADIATION EFFECT IN LEAF CABBAGE AFTER IRRADIATION BY PROTONS AND GAMMA RAYS **c04**

I. S. Skukina, Yu. I. Shaydorov, and V. N. Nekrasova *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 131-136 refs (See N72-14066 05-05)
Avail: NTIS

The effectiveness of protons and gamma radiation is dependent on the condition for illumination of the irradiated plants. This dependence was expressed more clearly with irradiation by protons than in the case of gamma radiation. Author

N72-14088# Joint Publications Research Service, Washington, D.C.

SOPORIFIC AND TOXIC EFFECT OF AMOBARBITAL SODIUM DURING 33-DAY HYPOKINESIA AND ISOLATION OF MICE **c04**

L. A. Kravchuk *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 137-140 refs (See N72-14066 05-05)
Avail: NTIS

A study was made of white male mice weighing 17-19 g. There were 30 animals in each of the three groups; the first was a control, the second was for reproducing the conditions of isolation, and the third was for simulating hypokinesia with insulation. It was found that the condition of the mice in the first, second, and third groups was dissimilar with respect to sensitivity to amobarbital sodium in relation to mean soporific doses, speed of onset of its action, time of onset and duration of sleep, and the mean toxic dosage. The breadth of the therapeutic effect of amobarbital sodium differed insignificantly in all animal groups. Author

N72-14089# Joint Publications Research Service, Washington, D.C.

EFFECT EXERTED ON ERYTHROPOIESIS IN FISH AND RATS BY WATER REGENERATED FROM HUMAN URINE **c04**

L. A. Telitchenko and M. M. Boychenko *In its* Space Biol. and Med., vol. 5, no. 5, 1971 22 Dec. 1971 p 141-142 refs (See N72-14066 05-05)
Avail: NTIS

The effects of biological and physicochemical methods of water generation from human urine on the erythropoietic systems of fish and rats were observed by changes in equilibrium between young and old erythrocytes during animal blood formations. Graphic representations of erythrocytic osmotic resistances with time showed that the greatest changes in fish and rats were caused by water regenerated in a psychochemical distillation method. G.G.

N72-14090# Advisory Group for Aerospace Research and Development, Paris (France).

CLINICAL CAUSES FOR GROUNDING

Heinz S. Fuchs Nov. 1971 192 p refs Presented at the AGARD Aerospace Med. Panel Specialist Meeting, Oporto, Portugal, 21-22 Jun. 1971
(AGARD-CP-89-71) Avail: NTIS

Papers given at the AGARD Aerospace Medical Panel

Specialist Meeting held in Oporto, Portugal from 21 to 22 June 1971 are presented. The subject was divided into two parts: the general aspects of clinical causes for grounding in the various air forces, and the specific aspects of grounding according to medical specialties. Each paper is followed by a discussion. A technical summary and an evaluation are included at the end. For individual titles, see N72-14091 through N72-14112.

N72-14091# Italian Air Force Medico-Legal Inst., Milan.
STATISTICAL SURVEY ON THE CLINCIAL CAUSES OF TEMPORARY GROUNDING AND PERMANENT UNFITNESS OF IAF AIRCREWS
Gaetano Rotondo *In* AGARD Clinical Causes for Grounding Nov. 1971 29 p refs (See N72-14090 05-05)
Avail: NTIS

An analytical study of the clinical causes that most frequently lead to temporary or permanent loss of fitness among flying personnel was undertaken. A wide statistical survey was made on morbidity, or rather some aspects of morbidity, in the personnel of the Italian Air Force, among the various categories or groups of categories connected with the flying service in general, and with particular regard to pilots. Such a study was undertaken with the hope of detecting the physio-psychic causes that have most weight and incidence in giving rise to unfitness for military service and for flying. It would then be possible to make practical suggestions in order to reduce the incidence of these causes and their disabling effects. Author

N72-14092# Royal Naval Air Medical School, Hillhead (England).
CLINICAL CAUSES FOR GROUNDING: A REVIEW OF ROYAL NAVAL EXPERIENCE, 1962 - 1970
I. H. Colley and F. St. C. Golden *In* AGARD Clinical Causes for Grounding Nov. 1971 11 p refs (See N72-14090 05-05)
Avail: NTIS

The clinical causes for permanent grounding in the British Fleet Air Arm, for the period January 1962 to December 1970 inclusive were examined. Clinical groundings constitute 13% of the total groundings for all reasons. Psychiatric illness is responsible for 58% of clinical groundings and was the major cause of wastage in trained aircrews. Author

N72-14093# Belgian Air Force, Brussels.
ANALYTICAL STUDY OF THE CAUSES OF MEDICAL UNFITNESS OF FLYING PERSONNEL IN THE BELGIAN AIR FORCE [ETUDE ANALYTIQUE DES CAUSES D'INAPTITUDE MEDICALE DU PERSONNEL NAVIGANT DE LA FORCE AERIENNE BELGE]
J. Bande and R. Moorthamers *In* AGARD Clinical Causes for Grounding Nov. 1971 11 p In FRENCH (See N72-14090 05-05)
Avail: NTIS

A comprehensive analysis was made of the causes of temporary and permanent unfitness, in cases treated by the ad hoc Medical Commission of the Belgian Air Force from 1965 to 1971. The study concerned 635 subjects, of whom 29.5% had a number of different disabilities; 7.6% of the cases were the object of permanent grounding and 12.9% were permanently limited in their fitness for the air service. 40% of the cases were accident victims. Of 904 disabilities, the pathology of the locomotor system was the most frequent, involving afflictions of both the neuropsychiatric and digestive systems. After eliminating accident cases, the most frequent pathology was of the digestive and respiratory tracts. A study of the correlation between age of the subject and the length of disability as a function of pathological class gave no conclusive results. Transl. by K.P.D.

N72-14094# Naval Air Station, Norfolk, Va.
A REPORT BF AVIATOR GROUNDING AND AVIATOR SALVAGE IN HIGH PERFORMANCE FIGHTER AIRCRAFT
Romaine L. Bendixen *In* AGARD Clinical Causes for Grounding Nov. 1971 8 p refs (See N72-14090 05-05)
Avail: NTIS

The role of the flight surgeon in the United States Navy, and particularly the role of the dually designated physician-pilot, is considered in the evaluation, treatment, and disposition of aviators flying in high performance jet fighter aircraft. Personal observations and experiences of the author as a pilot instructor-flight surgeon with a McDonnell F-4 (Phantom II) training squadron form the basis for the presentation and discussion of several cases involving the question of grounding for major clinical reasons. An integral part of these discussions is an attempt to demonstrate the value of the pilot-physician. This report covers a relatively short span of time, October 1967 through July 1969, but is particularly significant in the number of interesting cases that arose requiring evaluation and disposition. Author

N72-14095# School of Aerospace Medicine, Brooks AFB, Tex.
USAF AEROMEDICAL CONSULT SERVICE EXPERIENCE IN CAUSES FOR GROUNDING OVER THE PAST FIFTEEN YEARS
Malcolm C. Lancaster *In* AGARD Clinical Causes for Grounding Nov. 1971 7 p refs (See N72-14090 05-05)
Avail: NTIS

A marked change in the factors that relate to medical grounding of flyers in the United States Air Force (USAF) has occurred over the past 15 years. The increasing age of the flying population is the major causative factor producing this change. Improved diagnostic techniques and an increase in the fund of information about normals and individuals with early disease also had a significant influence upon both the types of problems evaluated and their disposition. The experience of USAF School of Aerospace Medicine over a period of 15 years is reviewed, and the trends and factors related to medical criteria for grounding USAF flyers are discussed. Author

N72-14096# Office of the Surgeon General (Air Force), Washington, D.C.
CAUSES FOR MEDICAL GROUNDING OF PILOTS AND NAVIGATORS IN THE UNITED STATES AIR FORCE, 1969
Robert A. Farmer and Howard R. Unger *In* AGARD Clinical Causes for Grounding Nov. 1971 6 p (See N72-14090 05-05)
Avail: NTIS

Specific indices and measures of the health of USAF-rated officers are computed from biometric data provided by the flight surgeon's medical recommendations. These data are discussed in relation to the health of Air Force flyers and the practice of aerospace medicine in the U.S. Air Force. Similarities and variations of medical practice and management are considered. Comparisons of the rates of removal and noneffective ratios by rating, age, and command are presented. Author

N72-14097# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
CLINICAL CAUSES FOR PERMANENT GROUNDING OF AIRCREW WITHIN THE GERMAN ARMED FORCES
H. J. Grunhofer and K. R. Mueller *In* AGARD Clinical Causes for Grounding Nov. 1971 9 p (See N72-14090 05-05)
Avail: NTIS

All clinical causes for permanent grounding of German armed forces pilots and other aircrew members were examined and analyzed statistically. The causes for medical disqualifications are divided into diagnostic groups or according to specific functions of organs and/or organ systems. Special emphasis is given to waivers and to certain psychological aspects. There were 24,396 physical examinations studied over a period of 11 years. Author

N72-14098# Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France). Service de Sante des Armees.
STATISTICAL ANALYSIS OF UNFITNESS OF FLYING PERSONNEL IN THE FRENCH AIR FORCE [STATISTIQUE

DES INAPTITUDES DU PERSONNEL NAVIGANT DE L'ARMEE DE L'AIR FRANCAISE]

J. Nathie, P. M. Pingannaud, and A. Gibert *In* AGARD Clinical Causes for Grounding Nov. 1971 6 p In FRENCH (See N72-14090 05-05)

Avail: NTIS

The physical fitness of flying personnel in the French Air Force is supervised by the Centers for Medical Evaluation of Flying personnel. A general study of 60,811 review evaluations made by the centers from 1960 to 1969 show that, among 1400 causes of observed unfitness (temporary unfitness excluded), the most numerous were neuropsychiatric disorders (381 causes) and inadequacy of the visual function (379 causes). These conclusions were made precise in a detailed study of the results in 1969, during which year 72 subjects were declared unfit. It appears that unfitness of neuropsychiatric origin is essentially motivated by psychological or psychosomatic difficulties. The disabilities recorded rarely led to the elimination of flying personnel, the majority being eventually discharged or reclassified into another specialty. The importance of statistical problems is emphasized and their solution by electronic data processing methods is proposed. Transl. by K.P.D.

N72-14099# Hellenic Air Force General Hospital, Athens (Greece). Dept. of Internal Medicine.

MEDICAL ASPECTS OF GROUNDING AND NONEFFECTIVENESS IN HELLENIC AIR FORCE PILOTS

C. E. Giannopoulos and H. G. Vissoulis *In* AGARD Clinical Causes for Grounding Nov. 1971 5 p refs (See N72-14090 05-05)

Avail: NTIS

Based upon statistics from Greek pilots' individual health files, hospital records, and the Aviation Supreme Medical Board's certifications, a ten year analytical study of the medical causes of admissions, waivers, suspensions, and permanent groundings is presented. Data on the medical causes for elimination from flying training are also discussed comparatively. From an average strength of 642 rated pilots, 24 were permanently grounded for medical reasons. The major cause was due to sensory deficiencies which accounted for 9 groundings, or 37.5% of the total. Peptic ulcer disease is the most frequent cause for noneffectiveness and accounts for several permanent groundings. The incidence of coronary heart disease is exceptionally low and should be attributed to the younger age distribution of the surveyed population. The elimination of two cadets for thalassemia minor and the finding of several cases of thalassemia trait among rated pilots brings into focus the problem of thalassemia, endemic in certain areas of Greece. Author

N72-14100# Naval Aerospace Medical Inst., Pensacola, Fla.

THE US NAVY SPECIAL BOARD OF FLIGHT SURGEONS: KEEP THEM FLYING SAFELY

M. D. Courtney *In* AGARD Clinical Causes for Grounding Nov. 1971 12 p (See N72-14090 05-05)

Avail: NTIS

In 1957 the United States Navy's Bureau of Medicine and Surgery directed the establishment of the Special Board of Flight Surgeons. This board consists of specialists in aerospace medicine and related fields who can make recommendations concerning the physical qualifications of Navy and Marine Corps aircrew personnel, which are necessary for them to continue in duty involving flying. The composition of the Special Board and its method of operation are described, and the kinds of cases referred to it for the past fourteen years and the recommendations made for the disposition of these cases are reviewed. Author

N72-14101# School of Aerospace Medicine, Brooks AFB, Tex.

CHANGING CONCEPTS IN MEDICAL REASONS FOR GROUNDING IN THE USAF AEROMEDICAL CONSULT SERVICE

John H. Triebwasser *In* AGARD Clinical Causes for Grounding Nov. 1971 9 p refs (See N72-14090 05-05)

Avail: NTIS

Flying safety is the major factor underlying medical decisions regarding a given aviator's fitness to fly. Over the past 15 years medical concepts were modified as experience with an older population and newer diagnostic techniques was gained. The incidence of degenerative disease has increased parallel with the age of the USAF aircrew member. Increasing emphasis must be placed on the early diagnosis of those conditions that could result in sudden incapacitation. Experience in aerospace medicine us limited to a younger, more healthy, population than that found in a hospital. The significance of several electrocardiographic findings usually associated with disease in a sick population is not necessarily of the same importance in the Air Force patient population. Four conditions that were considered representative of significant organic heart disease are considered. These are electrocardiographic repolarization changes, cardiac arrhythmias, acquired bundle branch block, and aortic valvular insufficiency. Author

N72-14102# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

CARDIOLOGIC FINDINGS AS CAUSE FOR GROUNDING

H. W. Kirchhoff and A. Dietz *In* AGARD Clinical Causes for Grounding Nov. 1971 3 p (See N72-14090 05-05)

Avail: NTIS

The routine cardiologic program performed at the Institute of Aviation Medicine of the German Air Force to determine fitness for military flying duty is described. It is comprised of an overall clinical examination, an electrocardiogram taken at rest, and the so-called master two-step test. If required, the physician may order additional electrocardiographic, mechanocardiographic, and functional medical tests. Armed forces regulation serves as the criterion for the final assessment and lists all findings which preclude, or render questionable, flying duty. Author

N72-14103# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

NEW FINDINGS CONCERNING THE IMPORTANCE OF ARRHYTHMIAS

A. Dietz *In* AGARD Clinical Causes for Grounding Nov. 1971 6 p (See N72-14090 05-05)

Avail: NTIS

Long term electrocardiograms (EKG's) are recorded at the Institute of Aviation Medicine of the German Air Force for any subject showing rhythmic cardiac disturbances. Long term registration is superior to routine EKG's with respect to recording arrhythmias. The advantages and techniques of long term EKG's are considered. Author

N72-14104# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

INCIDENCE OF CORONARY RISK FACTORS IN PILOTS OF THE BUNDESWEHR

Klaus Jung *In* AGARD Clinical Causes for Grounding Nov. 1971 10 p (See N72-14090 05-05)

Avail: NTIS

A group of 1000 pilots of different types of aircraft were examined with respect to distribution of various parameters, which, in extreme cases, constituted coronary risk factors. Cigarette consumption, serum cholesterol level, systolic and diastolic blood pressure, physical activity, body weight, vital capacity, fasting blood sugar level, automnesia, and family predisposition were studied in detail. For the sum of risk factors, the distributions were considered for total group, separate age groups, pilots grouped according to types of aircraft flown (total and in separate age groups), and for pilots under 30 years of age grouped according to aircraft flown and training status. Coronary stress is barely increased compared to a normal population. Prop pilots are, at least coronarily, jeopardized to the same extent as jet pilots. This is particularly true for older age groups. The greatest increment of psychophysical stress effects on the coronary system occurs between the start of training and the first flying experience, independent of the aircraft type flown. Author

N72-14105# Office of the Surgeon General (Air Force), Washington, D.C.

SUSPENSIONS OF PILOTS AND NAVIGATORS FROM FLYING STATUS FOR MEDICAL REASONS IN THE UNITED STATES AIR FORCE, 1969

Robert A. Farmer and Howard R. Unger *In* AGARD Clinical Causes for Grounding Nov. 1971 7 p (See N72-14090 05-05)

Avail: NTIS

The age distribution, causes, numbers, and diagnostic categories of medical suspensions of flying personnel in the U. S. Air Force which occurred in 1969 are discussed. Identification of preventive and clinical medical practices and policies which may prevent or remove the medical cause of the suspension are made possible by the study. Author

N72-14106# Royal Air Force Central Medical Establishment, London (England).

CURRENT NASAL AND AURAL INDICATIONS FOR GROUNDING

P. F. King *In* AGARD Clinical Causes for Grounding Nov. 1971 6 p refs (See N72-14090 05-05)

Avail: NTIS

The current indications for aircrew grounding due to nasal and aural disorders are described. The importance of careful preliminary selection is emphasized. The decreasing incidence of nasal infection was noted, together with the increasing part played by nasal allergy. The question of chronic bronchitis, bronchiectasis, and asthma, which complicate nasal disease, is discussed. Of the commoner aural lesions, otosclerosis as a cause of permanent grounding and the effect of stapedectomy are considered. Chronic otitis media and the indications for grounding, compared with those permitting continued flying, are examined. The relative and absolute indications for grounding in cases of chronic otitic barotrauma are discussed. Perceptive deafness and labyrinthine causes of vertigo and their influence on fitness to fly are also described. Author

N72-14107# Institute of Aviation Medicine, Fliegehorst (West Germany).

CAUSES FOR PERMANENT GROUNDING AND REJECTION IN THE ENT DEPARTMENT OF THE INSTITUTE OF AVIATION MEDICINE OF THE GERMAN AIR FORCE

G. Froehlich *In* AGARD Clinical Causes for Grounding Nov. 1971 3 p (See N72-14090 05-05)

Avail: NTIS

From 1959 to 1968 there were 22,800 periodic reexaminations of pilots and student pilots of the German armed forces. 55 or 0.24% of these were permanently grounded. In this group, 38 were students with marked high-tone hearing losses due to impact noise at the shooting range. The remainder suffered from recurrent barotitis (9), vestibular disease (3), chronic sinusitis (2), allergic rhinitis (1), and Meniere's disease (1). The rates for permanent rejections of applicants for flight training decreased considerably after the adoption of more flexible hearing standards in 1966. Again most of the rejections were due to considerable hearing losses caused by impact noise. In a sample of 2000 initial examinations, the rejection rates were highest among young Army officers and Army NCO's and lowest among Air Force applicants. The main causes for temporary grounding of applicants were sinusitis, marked septal deviations, catarrhal otitis media, and chronic tonsillitis. All these cases were accepted for flying training if there was full recovery after proper treatment. Cases with simple mastoidectomy and small atrophic scars of the tympanic membrane are acceptable, as well as cases with tympanoplasty type 1, provided the ears are functionally normal. Author

N72-14108# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

OPHTHALMOLOGICAL CAUSES FOR GROUNDING: A 10 YEARS REPORT

Dietrich Kuerschner *In* AGARD Clinical Causes for Grounding Nov. 1971 4 p (See N72-14090 05-05)

Avail: NTIS

From 1959 to 1969, 51 pilots in the German Air Force were permanently grounded on the basis of ophthalmological diagnoses. The total number of examinations made was 24,396. These 51 cases were classified according to diagnosis. They were as follows: anomalies of refraction (28), anomalies of color sense (3), anomalies of accommodation (1), anomalies of stereopsis (1), blepharitis (1), anomalies of pupillary function (1), cataract (2), aphakia (2), retinal diseases, including 2 retinal detachments (7), and glaucoma (5). Author

N72-14109# Canadian Armed Forces Inst. of Environmental Medicine, Toronto (Ontario).

DIABETES MELLITUS IN FLYING PERSONNEL

W. J. C. Stevenson *In* AGARD Clinical Causes for Grounding Nov. 1971 6 p refs (See N72-14090 05-05)

Avail: NTIS

The Central Aircrew Medical Board at the Canadian Forces Institute of Environmental Medicine assessed fifteen aircrew members in the past ten years who were referred because of abnormal glucose tolerance observed following incidental findings of reducing substances in the urine at time of routine urinalysis. The clinical findings, investigation procedures, and followup are discussed for two of the fifteen cases. These were referred because evidence suggested possible adult onset of diabetes mellitus. Four of the fifteen were permanently grounded; the remainder were returned to flight duties. One individual case was followed for ten years without development of the overt disease or any associated symptomatology. Reference is made to Canadian Air Force policy in dealing with cases of diabetes mellitus in aircrew members. Author

N72-14110# Royal Air Force, Farnborough (England).

PSYCHIATRIC CASUALTIES AMONG AIRCREW OF THE ROYAL AIR FORCE OF GREAT BRITAIN FOR TEN YEARS 1959 TO 1968

P. J. OConnor *In* AGARD Clinical Causes for Grounding Nov. 1971 4 p (See N72-14090 05-05)

Avail: NTIS

The causes of 262 permanent groundings for psychiatric illness in the Royal Air Force are discussed in detail for the ten years 1959 to 1968. One quarter of the cases were grounded for psychotic illness and three quarters for neuroses and personality disorders. Psychiatric wastage accounts for 10% of the total medical wastage. Author

N72-14111# Institute of Aviation Medicine, Fliegehorst (West Germany).

PSYCHOLOGICAL CAUSES FOR GROUNDING WITH SPECIAL CONSIDERATION OF PSYCHOSOMATIC SYNDROMES AND FEAR OF FLYING

K. Gerbert and H. P. Goerres *In* AGARD Clinical Causes for Grounding Nov. 1971 7 p refs (See N72-14090 05-05)

Avail: NTIS

One third of all groundings of pilots in the German Air Force within the last ten years was due to psychological reasons. This number is surprisingly high, considering the fact that the aviation psychologists do not routinely see every pilot. It is the task of the psychologists to select potential washouts and to investigate the causes of psychophysical performance decrements. Anxiety and fear are analyzed as flying stress reactions. Author

N72-14112# Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France).

FLIGHT GROUNDING FOR PSYCHOLOGICAL AND PSYCHIATRIC REASONS [LES INTERDICTIONS DE VOL POUR RAISONS PSYCHOLOGIQUES ET PSYCHIATRIQUES]

Rene Gelly *In* AGARD Clinical Causes for Grounding Nov. 1971 6 p In FRENCH (See N72-14090 05-05)

Avail: NTIS

Two sorts of psychopathology exist among aviators. The first is general, independent of the subject's professional life, and is associated with other aspects of his life. The second is a specific psychopathology which is due to the difficulties of aeronautic adaptation and which occurs almost uniquely in the domain of the subject's professional life. Observations made for French Air Force personnel in 1969 were collected and divided into classes, in order to study the distinction implied in diagnosis, prediction, treatment, and deciding flight aptitude in psychological cases. The classes considered were the general psychiatry of flying personnel and their specific psychopathology. Information on diagnostics, aptitude decisions, and development over a year of observation was also collected. Therapy and medical-administrative suggestions are presented for the two pathologies. Transl. by K.P.D.

N72-14113*# General American Transportation Corp., Niles, Ill. Systems Engineering Dept.

DESIGN AND FABRICATION OF A PROTOTYPE FOR AN AUTOMATIC TRANSPORT SYSTEM FOR TRANSFERRING HUMAN AND OTHER WASTES TO AN INCINERATOR UNIT ONBOARD SPACECRAFT, PHASE A

L. J. Labak, G. A. Remus, and R. Mansnerus Dec. 1971 88 p
(Contract NAS2-6386; GARD Proj. 1523)
(NASA-CR-114393) Avail: NTIS CSCL 06I

Three transport system concepts were experimentally evaluated for transferring human and nonhuman wastes from a collection site to an incineration unit onboard spacecraft. The operating parameters, merits, and shortcomings of a porous-pneumatic, nozzle-pneumatic, and a mechanical screw-feed system were determined. An analysis of the test data was made and a preliminary design of two prototype systems was prepared.
Author

N72-14114*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Advance Biotechnology and Power Dept.

PROGRAM OPERATIONAL SUMMARY: OPERATIONAL 90 DAY MANNED TEST OF A REGENERATIVE LIFE SUPPORT SYSTEM

J. K. Jackson, J. R. Wamsley, M. S. Bonura, and J. S. Seeman Washington NASA Jan. 1972 102 p refs
(Contract NAS1-8997)
(NASA-CR-1835; MDC-G2282) Avail: NTIS CSCL 06K

An operational 90-day manned test of a regenerative life support system was successfully completed. This test was performed with a crew of four carefully selected and trained men in a space station simulator (SSS) which had a two gas atmosphere maintained at a total pressure of 68.9, 10 psia, and composed of oxygen at a partial pressure of 3.05 psia with nitrogen as the diluent. The test was planned to provide data on regenerative life support subsystems and on integrated system operations in a closed ecology, similar to that of a space station. All crew equipment and expendables were stored onboard at the start of the mission to eliminate the need for pass-in operations. The significant accomplishments of the test, some of the pertinent test results, some of the problem areas, and conclusions are presented.
Author

N72-14115*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

THE INTEGRATION OF THE ORBITING PRIMATE EXPERIMENT WITH THE INTEGRATED MEDICAL AND BEHAVIORAL LABORATORY MEASUREMENT SYSTEM FOR A MANNED SPACE FLIGHT Final Report

R. B. Maine, J. M. Lagerwerff et al 22 Nov. 1971 163 p refs
(Contract NAS1-10593)
(NASA-CR-111996) Avail: NTIS CSCL 06B

The orbiting primate experiment (OPE) - integrated medical and behavioral laboratory measurement system (IMBLMS) study investigates the feasibility of combining the OPE with IMBLMS on-board an earth orbiting space vehicle, which vehicle is periodically visited by an astronaut crew, including a scientist-astronaut. The scientific objectives of the combined OPE-IMBLMS system are defined, recommendations for measurements are given, and a logical measurement sequencing and grouping is offended. A review of the existing capabilities of the two separate programs is presented with emphasis on the interfaces and integration requirements of the combined system. Data management techniques are detailed and a conceptual design for the combined system is delineated. Recommendations and conclusions are that it is entirely feasible and cost effective to place up to three dual primate experiments on-board a manned orbiting space vehicle. Utilization of the IMBLMS capability will result in substantially increased medical data yield from the primates which data are directly comparable to those obtained from the astronauts, and that the development of the necessary hardware lies within the present state-of-the-art.
Author

N72-14116# Civil Aeromedical Inst., Oklahoma City, Okla.

ALCOHOL AND DISORIENTATION-RELATED RESPONSES. 5: INFLUENCE OF ALCOHOL ON POSITIONAL, ROTARY, AND CORIOLIS VESTIBULAR RESPONSES OVER 32-HOUR PERIODS

Ronald J. Hill (Okla. Univ., Oklahoma City. Dept. of Otorhinolaryngology), William E. Collins, and David J. Schroeder Oct. 1971 18 p refs
(FAA-AM-71-39; Task-AM-A-71-PSY-27) Avail: NTIS

Influences of alcohol on both static and dynamic vestibular responses over 32-hour post-drinking periods. Thirty male subjects were divided into three groups of ten each: Control (no alcohol), Bourbon, and Vodka. Each group underwent eye-movement monitoring for responses to positional, rotational, and Coriolis stimulation. The subjects were tested immediately prior to ingestion of the test or the control beverage and for regular intervals up to 32 hours hours thereafter. Blood-alcohol levels were determined by gas chromatography. The usual PAN I and PAN II nystagmic responses were noted and, additionally, a direction-changing, positional nystagmus was obtained 24-32 hours after the ingestion of alcohol. Responses were generally depressed to angular accelerations and to Coriolis stimulation. There was no differential vestibular effect between congener and non-congener beverages.
Author

N72-14117*# Franklin Inst., Philadelphia, Pa.

SPACE AND RELATED BIOLOGICAL AND INSTRUMENTATION STUDIES Final Report, Mar. 1970 - Nov. 1971

R. J. Gibson and R. M. Goodman Nov. 1971 49 p refs
(Contract NSR-039-005-018)
(NASA-CR-125095; F-B2299) Avail: NTIS CSCL 06B

Research and experimental effort was carried out on high-density photo-optical recorder design, implantable pH electrodes and the mangetic/doppler blood-flow sensor.
Author

N72-14118# California Univ., Berkeley. Dept. of Civil Engineering.

SOME NUMERICAL ASPECTS IN THE IDENTIFICATION OF A CLASS OF NONLINEAR VISCOELASTIC MATERIALS: A PROBLEM SUGGESTED IN BIOMECHANICS

Nestor Distefano Aug. 1971 22 p refs
(Grant GM-16197-03)
(TR-71-25) Avail: NTIS

An identification problem in the field of nonlinear viscoelasticity is presented and discussed. The material under study is assumed to follow the law of elasticity given by a nonlinear Volterra integral equation. The functions g and f are given in parametric form, i.e., they depend in a known form on a number of unknown constants which, together with the constant E (modulus of instantaneous elasticity), form a vector a. Using a number of available, generally independent input-output pairs (sigma bar sub i, epsilon bar sub i), it is then necessary to find the vector for which the distances of the predicted outputs and the corresponding experimental functions, under a suitable metric, are a minima. Emphasis is placed on conceptual and numerical aspects of the problem. Applications in the field of biomechanics are stressed. Numerical experimental data are presented.
Author

N72-14119# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

DESIGN OF DIGITAL LOW-PASS AND BAND PASS FILTERS FOR BIOMEDICAL DATA SERIES

P. C. Chang and K. S. Su Feb. 1971 27 p refs Presented at the Biomedical Conf., San Diego, Calif., 22 Feb. 1971

(Contract AT(11-1)-1813)

(Conf-710217-1; UTEC-CE-71-18) Avail: NTIS

The design of zero phase-shift digital lowpass and bandpass filters for biomedical data series is presented. These filters are functioned by convoluting the data series properly truncated sinc functions. The design is based upon the principle that the Fourier transform of a sinc function is an idea lowpass filter with a rectangular window, and the difference of two such lowpass filters of different cut-off frequencies yields a bandpass filter with suitably chosen narrow band width. The practical consideration by choosing a suitable length of sinc function for biomedical data series and the frequency response of the resulting filters are described. Finally, application examples are given to demonstrate the procedure of digital computation and the characteristics and usefulness of the designed filters. Author

N72-14120# Ballistic Research Labs., Aberdeen Proving Ground, Md. Exterior Ballistics Lab.

A MATHEMATICAL MODEL OF OPTICAL ILLUSIONS AND FIGURAL AFTEREFFECTS

Evan Harris Walker Mar. 1971 46 p refs

(RDT/E Proj. 1T0-61102-A-33-D)

(AD-728141; BRL-1536) Avail: NTIS CSCL 06/16

Optical illusions constitute errors that accompany the brain's data reduction processes involved in pattern discrimination. The acquisition of an understanding of the cause of these visual aberrations will provide knowledge about the pattern recognition algorithms used by the eye and central nervous system which can aid efforts to model the brain's functions. The disparity between the 'apparent' line and the actual line that occurs in the case of peripheral vision is sufficient to produce the perceptual errors that occur in the Poggendorff, Hering and Muller-Lyer illusions. The magnitude of the Poggendorff illusion as a function of the line angle is derived and experimentally tested. The equations are further developed and used to derive Pollack's experimental results on figural after effects. The use of these concepts allows a degree of modeling of the central nervous system data reduction processes that may be of value in the development of pattern recognition for computer use.

Author (GRA)

N72-14121# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

NOISE AND HUMAN PERFORMANCE

Walter F. Grether Jun. 1971 50 p refs

(AF Proj. 7222)

(AD-729213; AMRL-TR-70-29) Avail: NTIS CSCL 05/10

The possible effects of noise on human performance have been the subject of considerable research dating back to 1916. Thus interest has been stimulated by concern about noise in factories, offices, schools, aircraft and other military vehicles. Two very direct and harmful effects of noise, permanent hearing loss and auditory masking, are treated only briefly in this review. Special attention is given to the so-called nonauditory effects on such performance measures as reaction time, vigilance, time estimation, tracking, manual manipulation, intellectual capacities, and industrial work tasks. Overall, the research data on noise and human performance appear rather contradictory and inconsistent. While many studies have found no performance impairment, and even improvement, there are some types of measures that rather consistently show decrements from exposure to noise. Some theoretical explanatory mechanisms to account for effects of noise on performance are included in the review.

Author (GRA)

N72-14122# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

AIRBORNE VISUAL RECONNAISSANCE AS A FUNCTION OF ILLUMINATION LEVEL

James L. Porterfield, Herschel C. Self, Steve A. Heckart, E. P. Hanavan, and Don F. McKechnie Jun. 1971 24 p refs

(AF Proj. 665; AF Proj. 7184)

(AD-728629; AMRL-TR-71-9) Avail: NTIS CSCL 05/10

An investigation was made of inflight visual detection of ground target sites and identification of specific targets as a function of apparent scene illumination. Individuals from three groups of six subjects each searched for tactical target sites in rolling farm and woodland, and identified and counted the targets at the sites located. One group observed under full sunlight illumination, a second group wore goggles with neutral density filters that cut the transmitted by 400 times full moonlight, and a third group wore goggles that reduced the light down by .0008 to an apparent illumination of 40 times full moonlight. The apparent scene illumination for both the groups that wore goggles was between that of the lower limit of civil twilight and sunrise or sunset. The subjects observed from the nose position of a B-50 flying at 180 knots ground speed and 3,500 feet above ground level. There were 25 target sites at various locations, all within two miles of the aircraft flight path, along the 96-mile track length. Each site contained various numbers and types of simulated tactical targets. The mean percent of target sites detected was 36 under sunlight illumination, 22 under the simulated 400 times full moonlight condition, and 9 under 40 times full moonlight. The mean percent of targets identified at the sites that were detected was 60 under sunlight, 34 under 400 times full moonlight, and 27 under 40 times full moonlight. Author (GRA)

N72-14123# Computer Image Corp., Denver, Colo.

THE INVESTIGATION AND SIMULATION OF DYNAMIC, INTERACTIVE DISPLAYS OF ACOUSTIC SIGNALS Annual Summary Report, 1 Jul. 1970 - 30 Jun. 1971

Frank David Wells 1 Jul. 1971 44 p refs

(Contract N00014-68-C-0383; NR Proj. 196-111)

(AD-728056) Avail: NTIS CSCL 05/10

Twenty-four psychological tests were conducted to evaluate the potential of animated visual displays for assisting subjects in learning to recognize and identify acoustic signals. A two-dimensional visual format was used to present the amplitude variations of frequency components comprising the signals over sixteen frequency bands of the audio spectrum. Two types of bandpass filter systems were employed for extracting the frequency information: (1) an analog cochlea having electrical properties analogous to the human ear, and (2) a set of 16 bandpass filters having uniform amplitude response characteristics. Results of the tests showed that bisensory presentations of nonredundant visual and auditory stimuli significantly improved the performance of subjects as compared to other modalities tested. Descriptions and block diagrams of the systems for generating the displays are given. A system was completed for generating a quasi three-dimensional display of amplitude variations for 16 spectrum channels over several seconds of immediately preceeding time and is now undergoing tests. These tests indicate that this time history display is superior to the two-dimensional format for portraying auditory information in the visual domain. A block diagram and a description of the system is given. Author (GRA)

N72-14124# Army Aeromedical Research Lab., Fort Rucker, Ala.

THE TESTING OF THERMAL PROTECTIVE CLOTHING IN A REPRODUCIBLE FUEL FIRE ENVIRONMENT, A FEASIBILITY STUDY

John D. Albright, Francis S. Knox, III, David R. DuBois, and George M. Keiser Jun. 1971 116 p refs Submitted for publication

(DA Proj. 3A0-062110-A-819)

(AD-729362; USAARL-71-24) Avail: NTIS CSCL 06/17

The report sets forth the conceptual design for a facility intended for development and evaluation of thermal protective clothing in a reproducible fuel fire environment. The methods developed relate thermal characteristics of fabrics to biomedical

aspects of burn prevention. A number of bioengineering problems are identified, the resolution of which is expensive and time consuming. It is concluded that construction of the facility designed is technically feasible. Due to the magnitude and complexity of the bioengineering problems identified, and because of advances in laboratory testing methods, however, construction bf such a facility is not considered to be a prudent expenditure of public funds at this time. Operationally oriented bioengineering/ aeromedical evaluation of thermal protective clothing systems remains essential. Author (GRA)

N72-14125# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
HUMAN FACTORS ENGINEERING Final Report
1 Sep. 1971 23 p refs Supersedes AD-725555, MTP-10-2-505, 19 Jul. 1967
(AMCR Proj. 310-6)
(AD-729855; AD-725555; MTP-10-2-505) Avail: NTIS CSCL 05/5

The document outlines procedures for evaluating the human factors associated with use of general equipment. Author (GRA)

N72-14126# Navy Experimental Diving Unit, Washington, D.C.
PRELIMINARY SURVEY OF DIVER ANTHROPOMETRICS Final Report
Hugh T. Beatty, Thomas E. Berghage, and Donald R. Chandler 1 Jun. 1971 28 p
(AD-729664; NEDU-RR-7-71) Avail: NTIS CSCL 05/5

Anthropometric data for Navy divers were collected and analyzed for mean, standard deviation, skewness and kurtosis. The data were analyzed by computer percentiles calculated and printed out. Author (GRA)

N72-14127# Air Force Systems Command, Wright-Patterson AFB, Ohio.
TRAINING TO IMPROVE ENDURANCE IN EXHAUSTING WORK OF MEN WEARING PROTECTIVE MASKS: A REVIEW AND SOME PRELIMINARY EXPERIMENTS Technical Report, Jul. - Oct. 1970
F. N. Craig, W. V. Blevins, and H. L. Froehlich Jul. 1971 25 p refs
(AD-729787; EA-TR-4535) Avail: NTIS CSCL 06/17

In order to identify some of the problems involved in protective mask training, small groups of medical volunteers were tested in exhausting work before and after 3 or 8 days of training. The men wore M9 and M17 masks with filters removed and with various inspiratory and expiratory resistances added. In addition to the resistance of the filter, the facepiece without the filter had a degrading effect on endurance. Available evidence indicates that physical fitness is a factor in endurance while wearing the protective mask. In inexperienced men the ratio of endurance when masked to endurance when unmasked is not affected by fitness. Author (GRA)

N72-14128# Virginia Univ., Charlottesville. Dept. of Psychology.
AN INVESTIGATION OF THE EFFECTIVE INTENSITY OF FLASHING LIGHTS Final Report
Edward J. Rinalducci and Kent E. Higgins Jun. 1971 52 p refs
(Contract DOT-CG-83635-A; CG Proj. 712102)
(AD-728587; USCG-712102-002) Avail: NTIS CSCL 05/10

The effective intensity of flashing lights was examined as a function of duration and area at threshold and suprathreshold illuminance levels and against different background luminances. In the first experiment the perceived brightness of a flashing point source of varying duration was equated to the brightness of a standard point source of a fixed duration. The intensity-time function obtained showed the well-known Broca-Sulzer effect only at suprathreshold levels. The data indicated that the maximum effect was found to occur at shorter durations with an increase in standard source illuminance. In the second experiment, the perceived brightness of a flashing light of fixed duration and varying area was equated to the brightness of a standard source of fixed area and duration. The intensity-area function obtained demonstrated a phenomenon which appeared analogous to the Broca-Sulzer effect, but in terms of area rather than time. The data indicated that brightness increased with area up to about 2' and then decreased between 5'-7' after which brightness appeared to be independent of size. Author (GRA)

N72-14129# Air Force Human Resources Lab., Brooks AFB, Tex.
IDENTIFYING ITEM VALIDITY INDICES UTILIZING A MULTIVARIATE MODEL Technical Report, Feb. - Apr. 1971
Pat-Anthony Federico Apr. 1971 14 p refs
(AF Proj. 1121)
(AD-729763; AFHRL-TR-71-16; Task-112103) Avail: NTIS CSCL 05/10

The study demonstrates and discusses a new procedure for performing item analysis which uses multiple discriminant analysis to establish efficiently and effectively an index of item validity. Application of this statistical technique to data derived from an attitude survey of three groups of students enrolled in technical training courses yielded the following results: It disclosed those stimulus items which were responsive enough to discriminate among criterion groups; it partitioned the total discriminatory power of the items into two homogeneous components; it yielded data for arriving at a special weighting scheme for scoring the final attitude form; and it located the positions of the criterion groups relative to the two orthogonal dimensions of the attitude universe. Author (GRA)

N72-14130# Naval Aerospace Medical Research Lab., Pensacola, Fla.
EARLY APTITUDE-ACHIEVEMENT DISCREPANCIES AS PREDICTORS OF LATER VOLUNTARY WITHDRAWAL FROM NAVAL AVIATION TRAINING
Richard E. Doll 7 Jun. 1971 10 p refs
(AD-728389; NAMRL-1134; NAVMED-MF 12.524.002-5013D) Avail: NTIS CSCL 05/9

During recent years there has been a marked increase in the drop-on-request (DOR) rate among aviation officer candidates (AOC's). This type of attrition has been exceedingly difficult to predict because of a lack of good measures of motivation. This study examines the hypothesis that any substantial discrepancy between aptitude and achievement may well be a product of motivation and that scores based on such discrepancies may be useful in identifying potential DOR's. Quadrant analysis of two independent samples showed the high aptitude-low achievement quadrant to have a higher DOR rate than any other quadrant. It is recommended that this type of analysis be incorporated as a secondary selection tool upon completion of the environmental indoctrination stage of training. Author (GRA)

N72-14131# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HUMAN ESTIMATION OF PROPORTIONAL DISTANCES AND DISTANCE RATIOS WITH THE AID OF A REFERENCE LENGTH
Nilss M. Aume Jun. 1971 32 p refs
(AF Proj. 7184)
(AD-730283; AMRL-TR-70-78) Avail: NTIS CSCL 06/6

Two experiments were conducted to investigate human ability to estimate the location of a target point. In the first experiment, a lateral distance between two remote points was displayed, and subjects were required to define, by means of a sighting device, a second lateral distance bearing a prescribed ratio to the first. In the second experiment, subjects were required to estimate the ratio of two displayed distances. Both experiments were conducted on an indoor, table-top range. A reference distance and a ratio aided accuracy in estimating distances. The findings suggest the value of a physically present reference distance for communicating the location of an obscure point. Author (GRA)

N72-14132# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

AIRBORNE VISUAL RECONNAISSANCE WITH YELLOW SUNGLASSES

Steve A. Heckart, E. P. Hanavan, James L. Porterfield, Herschel C. Self, and Don F. McKechnif Jun. 1971 19 p refs

(AF Proj. 7184)

(AD-730290; AMRL-TR-71-36) Avail: NTIS CSCL 05/5

The study investigated airborne visual reconnaissance with and without yellow sunglasses under conditions of moderate haze and high ambient, midday illumination. One group of five observers wore Bausch and Lomb Kalichrome C yellow glasses. A second group of five observers did not wear yellow glasses. The observers searched from the side scanner stations of a B-50 aircraft for tactical target sites located on rolling farm and woodland terrain. The aircraft flew at 180 knots ground speed, 3500 feet above ground. The mean percent of target sites detected by both the group that wore yellow glasses and the group that did not was 69 percent. For the sites detected, the group with yellow glasses identified 55 percent of the targets; the group without yellow glasses identified 70 percent. Because of large within group variance, this difference was not statistically significant. Thus, this study found yellow sunglasses to be of no value as an aid to visual reconnaissance in an area search task under conditions of high ambient illumination and moderate haze. Author (GRA)

N72-14133# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

INVESTIGATION OF INPUT NOISE APPROXIMATIONS ON HUMAN RESPONSE MODELING M.S. Thesis

Paul F. Torrey Jun. 1971 81 p refs

(AD-730142; GGC/EE/71-24) Avail: NTIS CSCL 05/8

A study was conducted to investigate the validity of approximating random Gaussian-distributed inputs used in human response modeling by sums of discrete sinewaves. An ideal rectangular power density spectrum was simulated using both filtered Gaussian-white-noise and sums of discrete sinewaves. These two input spectra were used in the same compensatory tracking task, and the resultant normalized tracking error and qualitative operator observations were used to show that there was no apparent differences in the effects of the two types of input spectra. In addition, parameter tracking was used to collect frequency response data on the discrete rectangular input spectrum. Parameter tracking data obtained with a first-order-filter continuous input was used to approximate results obtained with other input spectra of both the continuous and discrete type, which contained power in the crossover region. Author (GRA)

N72-14134# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

OPTIMAL SELECTION OF STABILITY AUGMENTATION SYSTEM PARAMETERS TO REDUCE THE PILOT RATINGS FOR THE PITCH TRACKING TASK M.S. Thesis

Teddy C. Hollis Jun. 1971 100 p refs

(AD-730143; GGC/EE/71-10) Avail: NTIS CSCL 01/3

A method for determining the optimal stability augmentation system (SAS) parameters for minimizing the pilot rating for the pitch tracking task is presented. The pilot rating prediction method is discussed. The Newton-Raphson method for finding the pilot parameters is introduced. The cost function used for finding the optimal SAS parameters is formulated to include SAS rate and deflection constraints. The optimization procedure is applied to the USAF/CAL T-33 variable stability airplane. Two different SAS configurations (pitch rate and pitch rate plus normal acceleration) are examined for six different flight conditions. The results show that the pilot rating predictions are reduced and a comparison with the military specifications show that the short period handling qualities are improved. Author (GRA)

N72-14135# School of Aerospace Medicine, Brooks AFB, Tex.

STUDIES OF SEMIAUTOMATIC TRACKING

A. I. Nazarov 1971 22 p refs Transl. into ENGLISH from Vopr. Psikhologii (USSR), v. 15, pt. 4, 1969 p 161-172

(AD-730193; SAM-TT-R-1110-0971) Avail: NTIS CSCL 05/8

Studies of tracking, no longer the concern of a narrow range of specialists, have led toward expansion of the concept of tracking itself, and to more general problems concerning the control of complex systems. The problem of coupling of man with machine, a key problem in systems engineering, has become inseparable from the problem of tracking and is sometimes directly reduced to the latter. Secondly, the methods of study used earlier only for analysis of tracking processes have become productive in the study of varied forms of human operator activity. The first section of the article on semiautomatic tracking analyzes certain characteristics of tracking as a special form of the process of regulation. The second section discusses theoretical models of tracking. GRA

N72-14136# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.

A MODEL FOR OPTIMIZING THE EFFECTIVENESS OF MAN-MACHINE DECISION MAKING IN A PATTERN RECOGNITION SYSTEM

Richard M. Fenker, Jr. and Selby H. Evans Jun. 1971 16 p refs

(Contract DAAD05-68-C-0176; DA Proj. 1T0-61102-B-81-a; THEMIS Proj. 367)

(AD-730944; HEL-TM-8-71) Avail: NTIS CSCL 06/4

Typical pattern-recognition processes can be separated into several components, some of which may be more readily automated than others. Humans seem to be particularly suited for the earlier parts of processing, such as delineating a part of the image to be recognized as a single object and adaptively selecting an effective feature space for a given task context. On the other hand, optimal decision processes--which give due weight to prior probabilities, take into account the differential costs of errors, and utilize efficient statistical classification procedures can now be automated on the basis of an already well developed body of knowledge. They may be better handled by machines than by men. Recent work suggests that a reasonable model for human pattern recognition can usefully incorporate processes such as mapping an unknown pattern into a subjective feature space and classifying it on the basis of its location in that space. In terms of this model and of the above considerations, the best point at which to tap into the human pattern recognition process may well be at the feature-space level rather than at the classification level. The paper proposes a method for relating this subjective feature to an objective feature space of a machine so that a human could serve as preprocesser and feature analyzer while the machine could carry out the statistical classification processes. Author (GRA)

N72-14137# Wyle Labs., Inc., Rockville, Md. Payne Div.

CALCULATION OF ROCKET POWERED TRAJECTORIES OF A PLANE OF SYMMETRY MODEL OF A HUMAN SUBJECT AND EJECTION SEAT Final Report, 1 Mar. 1970 - 15 Apr. 1971

Edward G. U. Band Aug. 1971 67 p refs

(Contract F33615-70-C-1420; AF Proj. 7231)

(AD-730907; WR-71-11; AMRL-TR-71-7) Avail: NTIS CSCL 01/3

A model of a seated human subject and ejection seat is proposed. The body is represented by a lumped parameter system consisting of five masses. The aerodynamic and dynamic forces, deflections and trajectories of this body are calculated for two zero speed and two high speed ejections, using different rocket characteristics. The adverse effects of suddenly applied accelerations is very evident when compared with constant acceleration. The model and the computer program described in the report may readily be adapted to further studies of ejection from high speed aircraft including limb flailing, rocket thrust characteristics etc. Author (GRA)

N72-14138# Army Aeromedical Research Lab., Fort Rucker, Ala.

STATIC COMPARISON OF VERTICAL TAPE AND

VERTICAL LIGHT EMITTING DIODE DISPLAYS Final Report
Robert H. Schrimsher, Andrew S. Martin, Kurt E. Lidke, Mark A. Hofmann, and Erwin G. Braun Aug. 1971 76 p refs
(DA Proj. 3A0-62110-A-819)
(AD-730316; USAARL-72-3) Avail: NTIS CSCL 05/8

The study was performed in three parts. The first part consisted of comparing a prototype light emitting diode vertical display with a current vertical tape display, for reading speed and accuracy, under two viewing angles, three levels of illumination, and two time conditions. The results indicated that the sixteen (16) aviators (subjects) over-estimated the LED instrument while the vertical tape instrument was under-estimated. In addition, absolute errors in reading were greater for the LED display than they were for the vertical display. Time conditions and angles did not have a significant effect, while illumination level for the LED's was of importance. Part II consisted of a human factors facial design evaluation for one vertical tape display and four prototype LED displays. All displays were found to be deficient when compared to military standards and research recommendations. Part III consisted of a photometric evaluation of the four LED displays. The results showed that these displays were unacceptable for viewing under high ambient light conditions and that gross luminance differences between individual diodes existed within the same display. Author (GRA)

N72-14139# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.
PERFORMANCE, RECOVERY AND MAN MACHINE EFFECTIVENESS Semiannual Progress Report, 1 Mar. - 31 Aug. 1971
Richard A. Dudek 15 Sep. 1971 26 p refs
(Contract DAAD05-69-C-0102; Proj. Themis; DA Proj. 1T0-14501-B-81-A)
(AD-729964; THEMIS-603) Avail: NTIS CSCL 05/8

The goals at the research are the determination of optimal or near optimal work/rest schedules for individuals and crews to yield high performance with minimal decrement over time followed by recovery (after rest) to an acceptable high performance. The experimentation is further aimed at consideration of various task levels and differing conditions of environment. Experimentation in progress continues to focus attention on the assessment of human performance under continuous operations or relatively long term activity (2 hours or more of activity). Effects of circadian rhythms on performance will also be studied in connection with this project. GRA

N72-14140# Texas Technological Univ., Lubbock.
THE PREDICTION OF INDIVIDUAL DIFFERENCES IN MONITORING PERFORMANCE Ph.D. Thesis
Wayne Leslie Waag Aug. 1971 125 p refs
(Contract DAAD05-69-C-0102; DA Proj. 1T0-14501-B-81-A)
(AD-730374) Avail: NTIS CSCL 05/8

The discipline of human factors engineering resulted in part from problems having their genesis in the second world war. The technology of war had advanced to the stage where weapon systems had become quite complex both in terms of their operation and maintenance. In many instances it was found that the operating requirements of the system far exceeded the capabilities of its human component. The resulting discipline took as its task the matching of system requirements to human capabilities. One solution, at least in part, has been the elimination of the human component altogether. Consequently many control systems have been designed so as to fully automate many important decision-making functions. Accordingly, man's role in the system has been reduced from an active to a passive component whose primary function is the monitoring of the system in order to insure its proper operation and to prevent certain malfunctions. Consequently the individual monitoring task has come to hold great importance in the proper functioning of many systems. Author (GRA)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-14141*# Pittsburgh Univ., Pa. Space Research Coordination Center.
KINETICS OF THE O PLUS O3 REACTION Ph.D. Thesis
J. L. McCrumb and F. Kaufman Dec. 1971 27 p refs Sponsored in part by ARPA
(Grant NGR-39-011-002; Contract DA-31-124-ARO(D)-440)
(NASA-CR-124745; SRCC-160) Avail: NTIS CSCL 07B

The gas phase reaction O + O3 yields 2 O2 was studied directly in a flow system under conditions of excess ozone, with O-atoms produced by thermal decomposition of Ar-O3 mixtures on a Nernst Glower, and measurement of the spatial O-atom decay by O + NO chemiluminescence with small, variable NO additions. The rate constant was found to be (9.6 + or - 0.7) x 10 to the minus 15th power cu/cm/molecule/sec at 298 K. Over the temperature range 269 to 409 K a rate expression (1.78 + or - 0.28) x 10 to the 11th power exp((-4.46 + or - 0.10 kcal/mole)/RT) is reported. The effects of interference by O2 (delta sub g) and product excitation are discussed, and the present results are compared with earlier investigations. Author

N72-14142*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF RADIATION IN PREPARATIVE CHEMISTRY
W. H. Philipp, S. J. Marksik, C. E. May, and R. A. Lad Dec. 1971 19 p refs
(NASA-TM-X-67982; E-6706) Avail: NTIS CSCL 07B

A summary and updating of previous work on the use of radiation chemistry for the preparation of pure materials are presented. Work was chiefly concerned with the reduction of metal salts in solution to the free metal using 2 MeV electrons. Metals deposited from aqueous solution are copper, silver, zinc, cadmium, thallium, tin, lead, antimony, iron, nickel, cobalt, and palladium. Dry organic solvents were evaluated for the deposition of metals based on a study involving deposition of antimony from soltions of antimony (III) chloride. The use of organic liquids for the preparation of anhydrous metal halides is also presented. Reaction mechanisms for both organic liquids and aqueous system are discussed. Author

N72-14143# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
ANALYTICAL COORDINATION CHEMISTRY SECTION Summary of Activities, Jul. 1970 - Jun. 1971
O. Menis and J. I. Shultz Dec. 1971 177 p refs
(NBS-TN-584) Avail: NTIS SOD $1.50 Order No. C 13.46:584

Progress in research and development in spectrophotometry, spectrofluorometry, flame emission, atomic absorption, thermal analysis, and the related program for the certification of Standard Reference Materials is described. Efforts to improve the accuracy in spectrophotometric measurements led to the construction of a NBS high accuracy spectrophotometer, the certification of glass filters (SRM 930) in the visible region of the spectrum, establishment of a more accurate value or molar absorptivity of the acid dichromate system, and the evaluation of spectrally neutral filters of interest in automation for clinical studies. Author

N72-14144*# Techtran Corp., Glen Burnie, Md.
CONTINUOUS MANUFACTURE OF PHTHALATES FROM PHTHALIC ANHYDRIDE AND HIGH BOILING ALCOHOLS
H. Suter Washington NASA Oct. 1971 10 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Germany), v. 41, no. 17, Jan. 1969 p 971-974

(Contjact NASw-2037)
(NASA-TT-F-13886) Avail: NTIS CSCL 07D

A description is given of a modern commercial synthesis of phthalates which produces 100,000 tons per year in continuous operation. This process yields 98% of the theoretical maximum, based on both phthalic anhydride and ethylhexanol. Author

N72-14145*# Techtran Corp., Glen Burnie, Md.
TESTING OF PLASTIC UTENSILS: POLAROGRAPHIC DETERMINATION OF DI-(2-ETHYLHEXYL)-PHTHALATE AND INVESTIGATION OF THE TENDENCY TO MIGRATION
H. Woggon and U. Koehler Washington NASA Dec. 1971 12 p refs Transl. into ENGLISH from Kunststoffe (West Germany), v.)7, no. 7, 1967 p 583-586
(Contract NASw-2037)
(NASA-TT-F-13889) Avail: NTIS CSCL 07D

Rigid PVC, which contains up to 5% di-(2-ethylhexyl)-phthalate as processing aid, was tested for its sanitary harmlessness for use in food service (This plasticizer must not be used in West Germany for plastic utensils which come in contact with foodstuffs). A pulse polarographic method was developed with which the smallest amounts of migrating plasticizer could be determined quantitatively. It was shown that the transfer to aqueous as well as alcoholic and fatty foodstuffs of a maximum 3 ppm is tolerably small; as a result, there should be no sanitary objection to the use of DEHP. Author

N72-14146*# National Aeronautics and Space Administration, Washington, D.C.
FLAME-INHIBITING PVC MIXTURES WITH CHLOROPARAFFINS. PART 2: MIXTURES WITH PHTHALIC ACID ESTER-PRIMARY PLASTICIZERS
K. M. Bell, B. W. McAdam, and H. J. Caesar Nov. 1971 8 p Transl. into ENGLISH from Kunststoffe (West Germany), v. 59, no. 6, 1969 p 344-346
(NASA-TT-F-13888) Avail: NTIS CSCL 07D

The PVC mixture plasticized with DIOP or DIOP/chloroparaffins cannot be regarded as flame inhibiting. The flame inhibition quality is only considerably improved by an addition of 5 parts by weight of antimony oxide. The low temperature strength of the mixtures is better than those made using phosphoric acid esters or phosphoric acid esters/chloroparaffins. The Sb2O3 is relatively expensive and an addition of 5 parts by weight appreciably increases the volume costs. Tables 9 and 10 show for each plasticizer system the properties of the most promising PVC mixtures. Mixtures with phosphate plasticizers and an addition of 10 parts by weight of DIOP offer no advantages with respect to the plasticizer systems treated. They were therefore not included. For purposes of comparison, the properties of mixtures containing no chloroparaffins are also given. Author

N72-14147*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SIMPLE SPECTROPHOTOMETRIC METHOD FOR DETERMINATION OF ZIRCONIUM OR HAFNIUM IN SELECTED MOLYBDENUM-BASE ALLOYS
William A. Dupraw Washington Jan. 1972 16 p refs
(NASA-TM-X-2452; E-6527) Avail: NTIS CSCL 11F

A simple analytical procedure is described for accurately and precisely determining the zirconium or hafnium content of molybdenum-base alloys. The procedure is based on the reaction of the reagent Arsenazo III with zirconium or hafnium in strong hydrochloric acid solution. The colored complexes of zirconium or hafnium are formed in the presence of molybdenum. Titanium or rhenium in the alloy have no adverse effect on the zirconium or hafnium complex at the following levels in the selected aliquot: Mo, 10 mg; Re, 10 mg; Ti, 1 mg. The spectrophotometric measurement of the zirconium or hafnium complex is accomplished without prior separation with a relative standard deviation of 1.3 to 2.7 percent. Author

N72-14148*# Translation Consultants, Ltd., Arlington, Va.
PHOTODISSOCIATION OF H2, N2, O2, NO, CO, H2O, CO2 AND NH3 IN THE EXTREME VACUUM UV SPECTRUM
K. D. Beyer and K. H. Welge Washington NASA Jul. 1971 18 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), v. 19a, no. 1, 1964 p 19-28
(Contract NASw-2038)
(NASA-TT-F-13864) Avail: NTIS CSCL 07D

Photodissociations in the extreme vacuum, UV region which produce particles with energies of excitation over 8 eV, were verified through fluorescence experiments in the Schumann UV region between 1500 and 1100 A. The fluorescent intensities were measured as a function of the radiated wavelengths between 1000 and 645 A. Irradiation of H2, O2, H2O, CO2 and NH produces highly excited H, O, and N atoms, CO and probably H2 molecules. In some cases, the types of dissociation can be determined from the fluorescent intensity as a function of radiated wavelength. The disintegration of H2 according to H2 yields H(IS) + H(2P) begins immediately above the dissociation energy for this process. Author

N72-14149# Stanford Univ., Calif. Center for Materials Research.
NEW SUPERCONDUCTORS Annual Technical Report, 1 Aug. 1970 - 31 Jul. 1971
William A. Little 31 Jul. 1971 160 p refs
(Contract N00014-67-A-0112-0056; ARPA Order 1681)
(AD-729694; CMR-71-15; ATR-1) Avail: NTIS CSCL 07/2

The objective of the program was to study the theoretical and synthetic problems of producing higher temperature superconducting materials. The report consists of four principal sections: A theory section concerned with the calculations of the effective electron-electron interaction in the vicinity of large organic molecules, calculation of Coulomb screening; The extension of band theory methods to linear systems; A synthesis section involved in the synthesis of transition metal linear organo-metallic systems of crystalline or covalently bound structures and with special ligand systems for control of the electronic environment of the metal atoms; An X-ray section for determining the structure of crystalline samples; and An experimental section for determining the material parameters of the prepared materials as functions of temperature and pressure. The synthetic portion includes the work on the so-called Krogmann complexes, cyanine dyes introduced into the glyoxime group, germanium oligomers, rhodium alalogs of the cobalt co-linear trimetallic monomer, SnCoSn, co-linear trimetallic monomers as tin-osmium-tin. GRA

N72-14150*# Techtran Corp., Glen Burnie, Md.
FRACTIONATION OF PHTHALIC RESINS, AND DETERMINATION OF THE DISPERSIONS OF THEIR MOLECULAR WEIGHTS
M. Filipska and W. Wojtania Washington NASA Nov. 1971 12 p refs Transl. into ENGLISH from Chem. Anal. (Warsaw), v. 14, 1969 p 821-828
(Contract NASw-2037)
(NASA-TT-F-13885) Avail: NTIS CSCL 07D

The preparative fractionation of domestically produced phthalic resins, determination of the limit viscosity number of the separated fractions, and mathematical and graphic estimation of the dispersion of the molecular weights in order to secure data for a more detailed characterization of the resins as coat-forming substances, are investigated. Author

N72-14151# Tyco Labs., Inc., Waltham, Mass.
CATALYSIS OF HYDROCARBON OXIDATION WITH ADSORBED LAYERS Semiannual Report
S. B. Brummer, M. J. Turner, and H. Feng Jun. 1971 63 p refs
(Contract DAAK02-71-C-0117; DA Proj. 1T0-61102-A-34-A)
(AD-729975; C-108; SAR-1) Avail: NTIS CSCL 07/4

Further investigations of the effect of Ni(2-) added to H3PO4 electrolytes on the oxidation of C3H8 at Pt electrodes

were carried out. Studies were made both with half-cells and complete cells. Measurements on C3H8-02 fuel cells at 130C were initiated. Generally 9 mg/sq cm Pt electrodes in 85% H3PO4 were used although some minor work in 80% H3PO4 and with 25 mg/sq cm Pt electrodes was also carried out. The results in 85% H3PO4 with 9 mg/sq cm Pt electrodes show no initual effect on cell performance due to the presence of either 20 mM or 200 mM Ni(2-). The self-poisoning characteristics of the amode, however, appear to be improved by the presence of Ni(2-). With 20 mM Ni(2-) in 85% H3PO4 and 25 mg/sq cm Pt electrodes, there is an initial improvement in cell performance of 35% at 0.44 V, 67% at 0.40 V, and 123% at 0.34 V. In 80% H3PO4, there is an initial enhanced cell performance with 20 mM Ni(2-) of 70% at 0.69 V, 52% at 0.59 V, and 10% at 0.49 V. The half-cell measurements with a reversible hydrogen electrode showed little effect due to the presence of Ni(2-). A catalytic effect of the nickel salt of an electrolysis product generated by the DHE is hypothesized to be the cause of the general observation of catalysis. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-14152 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL LINE-STORE STANDARDS CONVERSION: A FEASIBILITY STUDY
R. Walker 1971 15 p refs
(BBC-1971/44; UDC-621.397.63.621.377) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The analog line-store converters presently in use which convert video signals from the 625/50 standard to the 405/50 standard required for VHF transmission will reach the end of their service life before 405-line transmissions are terminated. An investigation was undertaken of the feasibility of a type of converter which processes the signal in digital form. The technical feasibility of digital processing at the rates required for line-store standard conversion, and the provision of equipment which could afterward be used for experiments to determine the optimum interpolation aperture, were studied. The results produced by the prototype converter showed that the necessary high speed digital processing is entirely feasible and economically viable. The output pictures produced were free of the type of defect associated with analog converters. Author

N72-14153 Washington Univ., Seattle.
RANDOM ANGLE MODULATION A TONE SIGNALLING TECHNIQUE Ph.D. Thesis
Philip Joseph Ferrell 1970 87 p
Avail: Univ. Microfilms Order No. 71-967

Random angle modulation (RAM) which allows many transmitters to simultaneously occupy a single channel and transmit information to a common receiver without recourse to time synchronization or subchannel filtering is discussed. Constraints upon the random modulating signal such as its frequency content and the desired amplitude probability density are derived. System performance is determined in terms of output signal-to-noise ratio (SNR). Detector output SNR is presented as a function of number of simultaneous signals, tone detector and channel bandwidths, signal input levels, and other system parameters. In addition, the RAM technique is simulated on a digital computer using the Monte-Carlo method with a pseudo-random noise generator. Chi-square evaluation indicates excellent agreement between theoretically predicted SNR and the results of the RAM simulation. Dissert. Abstr.

N72-14154 California Univ., Berkeley.
COMMUNICATION OVER FADING DISPERSIVE CHANNELS WITH FEEDBACK Ph.D. Thesis
Frederick Ernest Glave 1970 162 p
Avail: Univ. Microfilms Order No. 71-778

A binary, noiseless feedback communication scheme is proposed and analyzed for both the slow and the fast fading Rayleigh channels. In addition for block orthogonal M'ary communication over a general fading dispersive channel, a feedback scheme utilizing a fading dispersive feedback channel is proposed and analyzed. For this system, bounds on the error probability and corresponding reliability function are presented. For slowly fading and fast fading Rayleigh channels, the transmitter is turned on and off intermittently during each bit by an uncertainty variable fed back from the receiver through a noiseless feedback channel. At high energy-to-noise ratios, doubling the number of feedback iterations yields a 3rd power saving for the slowly fading channel. Power savings ranging from 1d for one feedback iteration to 9d for sixteen iterations are typical for the fast fading model. Dissert. Abstr.

N72-14155 Texas Univ., Austin.
THE EVALUATION OF REFLECTOR ANTENNAS Ph.D. Thesis
John Haven Davis 1970 203 p
Avail: Univ. Microfilms Order No. 71-115

The evaluation of large reflector antennas includes defining the effects of primary reflector astigmatism and its quantitative measurement through diffraction pattern measurements. A method is also presented which reveals the frequency dependence of antenna efficiency. Several basic problems are addressed. One is the focusing of reflector antennas and the interpretation of reflector errors from the antenna pattern. The second topic is the investigation of the effects of primary reflector astigmatism. Evidence is presented that several of the largest reflector antennas have astigmatism in their primary reflector. The third topic offers a method with which the antenna efficiency at one frequency can be inferred from the measured antenna efficiency at another frequency. The method given is much less restrictive than the Ruze method and bounds the effects of measurement errors. Dissert. Abstr.

N72-14156 Florida Univ., Gainesville.
COMPATIBILITY CONCEPTS FOR MODULATION SYSTEMS Ph.D. Thesis
Gerald Daniel Cain 1970 169 p
Avail: Univ. Microfilms Order No. 71-240

A general definition for modulation is adopted which embraces sampling theory, as well as the classical topics of amplitude modulation (AM), single-sideband amplitude modulation (SSB-AM), phase modulation (PM), and single-sideband phase modulation (SSB-PM). The aliasing distortion for deterministic waveforms sampled below the Nyquist rate is examined in detail. Prefilters and postfilters are then derived which eradicate the effect of aliasing for a class of functions with special symmetry properties. The contributions of other investigators toward establishing a compatible communication link between a SSB-AM transmitter and an AM envelope detector receiver are reviewed and presented in a common framework. Preprocessors and postprocessors appropriate for extending this notion of compatibility to other transmitter-receiver pairings (normally considered mismatched) are derived. Several pairings taken from the modulation types AM, SSB-AM, PM, and SSB-PM are shown to be amenable to suitable processing methods on a one-to-one pairing basis; in addition, processors are found that enable a single transmitter to simultaneously communicate with a variety of receiver types. Dissert. Abstr.

N72-14157 Texas Technological Univ., Lubbock.
AN INVESTIGATION OF HIGH ORDER PHASELOCK SYSTEMS Ph.D. Thesis
Alonzo Franklin Adkins 1970 127 p

Avail: Univ. Microfilms Order No. 71-522

Methods of implementing unconditional stability in higher order loops having desirable response characteristics are considered. The major phaselock systems are included in the investigation; the phaselock loop FM demodulator, and the phaselock carrier tracking loop. A Butterworth loop is shown to have an advantage over other loop configurations employed as FM demodulators, in that a low pass Butterworth response is inherent to the loop configuration itself. The performance of the FM demodulator loop is evaluated in terms of the FM response noise bandwidth and the closed loop noise bandwidth.

Dissert. Abstr.

N72-14158*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPACE BASE ANTENNA STUDY

Leonard F. Deerkoski Mar. 1971 40 p refs

(NASA-TM-X-65776; X-811-71-98) Avail: NTIS CSCL 09E

The field of view required of the space base antenna is defined for both the tracking and data relay satellite link and detached module links. The gain requirements are established and the feasibility of alternative antenna configurations using phased arrays and reflectors are considered. One recommended and one alternative configuration are presented for each of the required links.

Author

N72-14159*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OMEGA TIME TRANSMISSIONS AND RECEIVING REQUIREMENTS

A. R. Chi, L. A. Fletcher (Naval Electron. Comm., Arlington, Va.), and C. J. Casselman (Naval Electron. Lab., San Diego, Calif.) Nov. 1971 18 p refs

(NASA-TM-X-65780; X-810-71-479) Avail: NTIS CSCL 17B

A short history is given of the development of dual VLF time transmission techniques. The theory of time recovery from the relative phase of the dual frequency transmission is presented. The transmission and receiving requirements for cycle identification and cycle ambiguity resolution are described. Finally, an experiment to test the capability of time transmission of the OMEGA system is proposed

Author

N72-14160# Joint Publications Research Service, Washington, D.C.

NONLINEAR AND MICROWAVE RADIO ENGINEERING SYSTEMS

L. D. Bakhrakh and V. I. Samoylenko, eds. 22 Dec. 1971 145 p refs Transl. into ENGLISH from the book "Nelineynyye i Sverkhvysokochastotnyye Radiotekhnicheskiye Sistemy, Trudy Moskovskogo Ordena Lenina Aviatsionnogo Instituta imeni Sergo Ordzhonikidze" Moscow, Machine Building Press 1970 p 166-183 and 206-325

(JPRS-54764) Avail: NTIS

Switching devices and antennas are considered, especially in microwave and semiconductor applications. Design, operating characteristics, and optimization are discussed. For individual titles, see N72-14161 through N72-14168.

N72-14161# Joint Publications Research Service, Washington, D.C.

AN ANALYTICAL METHOD FOR SOLVING DYNAMIC EQUATIONS OF THIN FERROMAGNETIC FILMS FOR SLOW SWITCHING FIELDS

E. G. Dedyan and N. V. Obukhov *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 1-8 refs (See N72-14160 05-07)

(UDC-629.7.051:621.396.66.001) Avail: NTIS

The switching characteristics of ferromagnetic films were observed along a longitudinal axis (axis of most easy magnetization). Various rates of increase were noted, and a solution for the dynamic equation for a film in slow switching fields is presented. The solution permits the investigation of switching in films as a function of other parameters.

K.P.D.

N72-14162# Joint Publications Research Service, Washington, D.C.

UNIJUNCTION TRANSISTORS AND THEIR POSSIBLE APPLICATIONS c09

A. K. Grebnev, A. I. Krivonosov, and V. I. Ruslanov *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 9-18 refs (See N72-14160 05-07)

(UDC-629.7.051:621.396.6.001) Avail: NTIS

Unijunction transistors are discussed as a type of semiconductor device. Their advantages are: the presence of a stable region of negative resistance characteristics, weak dependence of switching voltage on temperature, high resistance in a closed state and low resistance in an open one, and a high degree of reliability (failure amounts to less than 0.01% per thousand hours of operation). Integrated circuits may be assembled with unijunction transistors. Simple and reliable circuits can be designed using these devices. Their application in rocket control systems and artificial earth satellite instrumentation is also considered.

Author

N72-14163# Joint Publications Research Service, Washington, D.C.

A MICROWAVE SWITCH BASED ON THIN FERROMAGNETIC FILM c09

P. A. Puzyrev and Yu. I. Voloshchenko *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 19-29 refs (See N72-14160 05-07)

(UDC-629.7.051:621.37.001) Avail: NTIS

The design and analysis of a microwave switch are presented. A homogeneous film model was used for the network analysis. Homogeneous films with neutral magnetostriction are necessary to decrease attenuation in the open state. Switching characteristics are also discussed. These make it possible to use the switch as an amplitude or balance modulator, and also as a step phase inverter.

K.P.D.

N72-14164# Joint Publications Research Service, Washington, D.C.

A STUDY OF ANTENNAS WITH FREQUENCY BEAM SCANNING c09

D. B. Zimin and V. S. Losev *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 30-68 refs (See N72-14160 05-07)

(UDC-629.7.051:621.396.6.001) Avail: NTIS

The limiting characteristics of a linear antenna are considered. The discussion is restricted to a series circuit for constructing a bar with the use of a delay system. The calculation of serpentine waveguide delay systems is presented. Rectangular waveguide bending was also investigated mathematically.

K.P.D.

N72-14165# Joint Publications Research Service, Washington, D.C.

CONCERNING THE DISTORTIONS OF SPIRAL ANTENNA RADIATION CHARACTERISTICS

F. L. Ayzin *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 69-80 refs (See N72-14160 05-07)

(UDC-629.7.051:621.396.029.001) Avail: NTIS

A mathematical analysis of wave reflection, attenuation, and excitation characteristics is presented for spiral antennas. The presence of such features leads to noticeable distortion of the radiation pattern and polarization of the field being radiated.

K.P.D.

N72-14166# Joint Publications Research Service, Washington, D.C.

CALCULATION AND DESIGN OF DIODE SWITCHING DEVICES IN THE DECIMETER RANGE c09

G. F. Vasilyev, Yu. A. Yevdokimenko, and V. N. Ginzburg *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 81-100 refs (See N72-14160 05-07)

(UDC-629.7.051:621.396.6.001) Avail: NTIS

Discrete switching devices controlled by p-n diodes, were

investigated for the microwave range. A circuit diagram of point contact and diffusion semiconductor diodes which is valid in this range is presented. A mathematical model for an on-off switching circuit is given. An analysis of phase inverter circuits is also presented, and their optimization is discussed. An experimental investigation of various phase inverter models was conducted.
K.P.D.

N72-14167# Joint Publications Research Service, Washington, D.C.
A STUDY OF SOME CHARACTERISTICS OF DIODE SWITCHING DEVICES IN THE DECIMETER RANGE c09
G. A. Bukhonina, G. F. Vasilyev, V. A. Galkovskiy, I. Ye. Golberg, and V. N. Ginzburg *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 101-128 refs (See N72-14160 05-07)
(UDC-629.7.051:621.396.6001) Avail: NTIS

The results of an investigation of discrete switching devices in the decimeter range, controlled by semiconductor p-n junctions, are explained. The values for basic electrical parameters of changeover switch models (loss and phase frequency characteristics) were in good agreement with the calculated data. Certain parameters of diode switching devices that are important in practice are discussed. An analysis was performed for the limitations imposed by reactions of high frequency circuits on the rapid operation of diode switching devices. Some associated limitations in the band width of these devices (commutators) in the decimeter range were analyzed. Operational features at the power levels of the microwave signal close to the limiting value for the controlling diodes were considered. Author

N72-14168# Joint Publications Research Service, Washington, D.C.
THINNED ANTENNA ARRAYS WITH SMALL SIDE LOBES
V. V. Sazonov and V. P. Yakovlev *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 129-145 refs (See N72-14160 05-07)
(UDC-629.7.051:621.396.6.001) Avail: NTIS

The construction of optixum thinned arrays in order to increase noiseproof features is discussed. Statistical calculations for error estimation for the arrays are presented. A computer analysis of antenna radiation patterns was performed, and the distributions for a random pattern and for traces of a pattern above a given level were investigated. A comparison of theoretical conclusions and calculated results is given. K.P.D.

N72-14169*# National Aeronautics and Space Administration, Washington, D.C.
SPACEBORNE ELECTRONIC IMAGING SYSTEMS NASA Space Vehicle Design Criteria (Guidance and Control)
Jun. 1971 71 p refs
(NASA-SP-8078) Avail: NTIS CSCL 09F

Criteria and recommended practices for the design of the spaceborne elements of electronic imaging systems are presented. A spaceborne electronic imaging system is defined as a device that collects energy in some portion of the electromagnetic spectrum with detector(s) whose direct output is an electrical signal that can be processed (using direct transmission or delayed transmission after recording) to form a pictorial image. This definition encompasses both image tube systems and scanning point-detector systems. The intent was to collect the design experience and recommended practice of the several systems possessing the common denominator of acquiring images from space electronically and to maintain the system viewpoint rather than pursuing specialization in devices. The devices may be markedly different physically, but each was designed to provide a particular type of image within particular limitations. Performance parameters which determine the type of system selected for a given mission and which influence the design include: Sensitivity, Resolution, Dynamic range, Spectral response, Frame rate/bandwidth, Optics compatibility, Image motion, Radiation resistance, Size, Weight, Power, and Reliability. Author

N72-14170# Messerschmitt-Boelkow G.m.b.H., Munich (West Germany).
STUDY ON OMNIDIRECTIONAL SATELLITE ANTENNAS FOR TELEMETERING AND TRACKING IN THE UHF BAND Final Report
Karl A. Koob and Gerhard P Zerwes Nov. 1970 114 p refs
(Contract ESTEC-816/69-HP-01607/70-WK)
(TN-KE2-59/70) Avail: NTIS

A description of theoretical and practical antenna models is presented. A short explanation of the theoretical aspects of isotropic and quasi-isotropic antennas is given. Six possible types are analysed and described. Antenna systems using circumferential arrays fed in phase or with 2pi phase variation and systems using only few radiators with orthogonal polarization were found to be the adequate solutions for large structures. The antenna system with few radiators which is based on the principle of the orthogonal polarization has been investigated experimentally. The measurements were performed with two different scaled down satellite models. It could be shown clearly that the theoretically predicted quasi-isotropic radiation characteristic can be realized.
Author

N72-14171# Joint Publications Research Service, Washington, D.C.
EFFECT OF NON-LINEARITY ON THE GENERATION OF SIGNALS CIRCLING THE EARTH
A. V. Gurevich 19 Jan. 1972 13 p refs Transl. into ENGLISH from Geomagnetika i Aeronomiya (Moscow), v. 11, no. 6, Nov.-Dec. 1971 p 961-969
(JPRS-54976; UDC-550.388.2) Avail: NTIS

The spreading around the earth of short radiowaves is examined, taking into account the inhomogeneity of the ionosphere, i.e. changes in the ionosphere along the route of the beam as it transmits from the day-side to the night-side. The properties of round-the-world wave channels and the effective volume of the waveguide and absorption of the waves being propagated are determined. Also examined is the trapping of radiowaves into earth-circling channels. It is shown that, due to nonlinear defocusing of powerful narrow beams, a portion of the beam energy can be trapped in an ionospheric, earth-circling channel, with minimal absorption. Author

N72-14172# Joint Publications Research Service, Washington, D.C.
DISTURBANCE OF IONOSPHERE BY RADIOWAVES
A. V. Gurevich 19 Jan. 1972 11 p refs Transl. into ENGLISH from Geomagnetika i Aeronomiya (Moscow), v. 11, no. 6, Nov.-Dec. 1971 p 953-960
(JPRS-54975; UDC-550.388.2) Avail: NTIS

The disturbance of ionospheric plasma by powerful radio waves is examined. It is shown that at altitudes z < or approximately = 200 km, the concentration of electrons N increases under the influence of the radio wave field (Delta N > 0). In the range of 200 < or approximately = z < or approximately = (250 to 300) km, the N disturbances are insignificant. However, in the area where the F layer is at the maximum (z is approximately 300 to 400 km) and above, N disturbances increase again (Delta N < 0). Author

N72-14173*# Scripta Technica, Inc., Washington, D.C.
METEOSAT: PCM TRANSMISSION OF IMAGES
N. Darche Washington Feb. 1971 47 p refs Transl. into ENGLISH of "Meteosat Transmission PCM des Images: Definition du Formatiansi que de la Strategie du Synchronisateur Secondaire", Centre Natl. d'etudes Spatiales, Bretigny, France, Report 567/CB/ES/E
(Contract NASw-2036)
(NASA-TT-F-13834; Rept-567/CB/ES/E) Avail: NTIS CSCL 09F

A format definition is given and the strategy proposed for the secondary synchronizer is detailed. A justification scheme for the code choice is included. D.L.G.

N72-14174*# Scientific Translation Service, Santa Barbara, Calif.
REDUCING THE STRUCTURAL AND FUNCTIONAL REDUNDANCY IN COMPLEX INFORMATION SYSTEMS
Ya. A. Dubrov Washington NASA Aug. 1971 10 p refs Transl. into ENGLISH of "Sokrashcheniye Struyktyrnoy i Funktsional'noy Izbytochnosti v Slozhnykh Informatsionnykh Sistemakh" in "Chetverty Simpozium po Probleme Izbytochnosti v Informatsionnykh Systemakh" Leningrad, Acad. of Sci. (USSR), 1970 p 216-223
(Contract NASw-2035)
(NASA-TT-F-13872) Avail: NTIS CSCL 09D

A finite system, developed by the author, is used to study some problems of complex information systems. Significant attention is devoted to questions of equivalent system transformations, since such transformations make it possible to eliminate structural and functional redundancy in complex information systems. Author

N72-14175*# Scripta Technica, Inc., Washington, D.C.
MATHEMATICAL PROBLEMS OF COMPRESSING LARGE MASSES OF MEASUREMENT INFORMATION
A. S. Golubkov and A. V. Sharonov NASA Oct. 1971 5 p refs Transl. into ENGLISH of "Matematicheskiye Voprosy Szhatiya Bolshikh Massivov Izmeritel'noy InformatSii" in "Chetverty Simpozium po Probleme Izbytochnosti v Informationnykh Sistemakh" Leningrad, Acad. of Sci. (USSR), 1970 p 123-129
(Contract NASw-2036)
(NASA-TT-F-13871) Avail: NTIS CSCL 09B

A study is made of a method of compressing large masses of information that utilizes the properties of Markov chains with a countable phase space. Work on the construction of new technological models requires, in addition to preliminary studies and calculations and the development of the models themselves, very complex and extensive laboratory, bench, and field experiments. The information regarding the object in question can be obtained by measurement of the parameters of the processes that take place in it. Here, the large number of these parameters, the briefness of the processes, etc. make it necessary to develop efficient control methods. A method that, under certain restrictions on the processes actually taking place, allows a compression of the measurement information, is considered. The work is confined to Gaussian processes with independent increments that, with probability, have continuous trajectories.
Author

N72-14176# Sedco Systems, Inc., Farmingdale, N.Y.
INTEGRATION OF INERTIALESS SCANNED WEATHER RADAR ANTENNA WITH RADAR SET AN/APN-158 Final Report, 28 Nov. 1969 - 30 Oct. 1970
Leo Simpson Sep. 1971 38 p refs
(Contract DAAB07-70-C-0112)
(AD-730785; ECOM-0112-F) Avail: NTIS CSCL 17/9

The program consisted of the design and development of special purpose interface equipment to enable the Inertialess Scanned Weather Radar Antenna to be integrated with Radar Set AN/APN-158. The interface equipment was comprised of special purpose digital-to-analog conversion circuits to enable the digital azimuth scan number to drive the X and Y sweep circuits of the PPI indicator. The interface also contained D.C. power supplies and timing buffer circuits to synchronize the operation of the two groups of equipment. The report described the principal circuits in detail, and summarizes the results of the operational tests performed on the integrated system.
Author (GRA)

N72-14177# Hokkaido Univ., Sapporo (Japan). Research Inst. of Applied Electricity.
SHF AND EHF PROPAGATION IN SNOWY DISTRICTS
Akio Matsumoto and A. Nishitsuji 1971 106 p refs
(Mono-Ser-19) Avail: NTIS

Seven papers are presented covering the theory and field testing of radio wave propagation during snowfall. Methods of measuring the falling velocity of snowflakes and the instantaneous rate of snow precipitation are discussed. The drop-size spatial distribution of minute particles (i.e., very small snowflakes) is of special interest. The whole frequency range of radio waves from very low to extremely high frequencies is considered. Author

N72-14178# European Organization for Nuclear Research, Geneva (Switzerland).
STUDY OF HYBRID ELECTROMAGNETIC WAVES IN CYLINDRICAL STRUCTURES: APPLICATION OF RESULTS TO DEFLECTOR MODES
V. Vaghin 28 Jan. 1971 135 p refs In FRENCH
(CERN-71-4) Avail: AEC Depository Libraries

Theoretical and experimental studies were made of the properties of hybrid waves in different cylindrical structures. The general theory of hybrid waves is given first. The deflecting and focusing properties of hybrid waves are considered. It is shown that hybrid waves being propagated in a plasma column exposed to an infinite external magnetic field have the same deflecting and focusing properties as in a vacuum. In order to study the hybrid waves, a general structure model consisting of a cylindrical guide filled by two coaxial layers of anisotropic dielectrics was chosen. This model contains a large number of possible deflecting and focusing structures. The criterion of existence of the inverse waves for this model is proved rigorously. The problem of complex waves is discussed, and the method of obtaining the dispersion relation is presented. NSA

N72-14179# Air Force Academy, Colo.
DESIGN OF AN OPTIMUM RADAR SIGNAL TO REJECT CLUTTER
Dudley C. Lancaster Aug. 1971 110 p refs
(AD-730323; RADC-TR-71-172) Avail: NTIS CSCL 17/9

The report presents a method of designing an optimum radar signal to reject clutter using a polynomial in time to represent the waveform. Solutions are found for different problem parameters, and the resulting waveform, its frequency spectrum, and its ambiguity function are plotted for each solution. Author (GRA)

N72-14180# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Satellitenelektronik.
A SIMPLE METHOD OF SIGNAL RECEPTION FROM A SATELLITE USING AN OMNIDIRECTIONAL ANTENNA DIVERSITY SYSTEM WHICH ELIMINATES MULTIPATH FADING
W. Goebel [1971] 15 p Presented at the 11th DGLR European Space Symp., Berlin, May 1971
Avail: NTIS

An omnidirectional antenna diversity system is proposed for use on ships, which eliminates multipath fading due to ocean surface reflection. The antenna consists of simple omnidirectional slot- and crossed-dipoles, and ground planes. The signal levels are interrogated by an electronic commutator and evaluated by auxiliary receiver. Automatic gain control voltages of the antenna lines are evaluated by logic, which determines the maximum antenna signal to be selected. Experiment with AZUR and ATS-3 signals is reported. ESRO

N72-14181# Northrop Corp., Palos Verdes Estates, Calif. Electronics Div.
DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Progress Report, 16 Nov. 1970 - 16 Mar. 1971
Walter F. Goede Aug. 1971 26 p refs
(Contract DAAB07-70-C-0110; DA Proj. 1H6-62705-A-055-03-42)
(AD-728841; NORT-70-353-4; ECOM-0110-4; PR-4) Avail: NTIS CSCL 17/9

The report describes the progress to develop a 32 x 52-resolution-element, digital address, thin display tube for a

man-pack radar. During this quarter the low-power driving circuitry was completed, and the first 32 x 52-element display unit was completed and tested. In addition, further work was accomplished on minimizing the cathode power consumption. The performance of the display unit was very good. Brightness and contrast were 100 foot-Lamberts and 10:1 respectively. The only area in which achieved performance did not meet or equal the objectives was in total power consumption; power input for the tested display was 2.8 watts, as compared to the objective of 1 watt. Author (GRA)

N72-14182# Naval Academy, Annapolis, Md. Dept. of Electrical Engineering.
CRITERIA FOR DETERMINING CONTROL RESOLUTION USING HARMONICALLY RELATED ELLIPSES Interim Technical Report
Frank P. Kuhl Aug. 1971 10 p refs
(AD-729027; EW-71-4; WR-2-0071) Avail: NTIS CSCL 17/9

Identification of targets whose parametric classifications consist of tightly interweaved contours requires a finely quantized classification space. The minimum usable grid size is determined by describing each contour as an infinitude of harmonically related ellipses and by considering the resultant ellipses, equipment bandwidth, and signal noise. Author

N72-14183# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF COORDINATES OF REFLECTING POINTS ON THE METEOR STATION KGU-M4
G. B. Pokrovskii, V. V. Sidorov, B. K. Mikhailov, R. Yu. Fakhrutdinov, and A. N. Fakhrutdinova 28 Jul. 1971 13 p refs Transl. into ENGLISH from Meteornoe Rasprostr. Radiovoln (SSR), no. 5-6, 1969 p 238-245
(AD-729083; FTD-MT-24-106-71; DIA-Task-T65-05-20; AR/0000/69/000/5/5) Avail: NTIS CSCL 17/9

The difficulties in calibrating a short antenna base of a measurement complex associated with the relative influence of closely spaced antennas necessitated the use of a method for excluding ambiquity when the role of a short base is played by the difference in two long bases differing from another in the development of a new variant of a meteor radar station for Kazan: University (KGU-M4). The article discusses the factors involved in selecting lengths of measurement bases.
Author (GRA)

N72-14184# University of Botswana, Lesotho and Swaziland, Roma (Lesotho).
TRANS-EQUATORIAL TRANSMISSIONS AT VERY HIGH FREQUENCY Annual Report, 1 Sep. 1968 - 31 Aug. 1969
Eric H. Carman, Margaret P. Heeran, and Michael A. Anastassiadis Griffiss AFB, Ohio RADC Jul. 1971 244 p refs
(Contract F61052-67-C-0003)
(AD-728723; RUAL-16; RADC-TR-71-143; AR-3) Avail: NTIS CSCL 20/14

Data collected at Roma, Lesotho and near Pretoria, Republic of South Africa, from the 40 MHz Greek Police FM system during the period September 1968 through August 1969 is recorded. Synoptic analysis of occurrence and signal strength of these transequatorial-F transmissions together with earlier data collected since March 1967 is presented. Path losses and path analysis for frequencies in the range 34-72 MHz are discussed in relation to the Athens-Roma TEF circuit in preparation for analysis of transmissions on 34, 45.1 and 72 MHz already in progress at the time of preparation of the present report. The discussion includes proposals for investigation of the TEF path by ground based and satellite born ionosondes, together with optical (airglow) methods. Author (GRA)

N72-14185# University of Botswana, Lesotho and Swaziland, Roma (Lesotho).
TRANS-EQUATORIAL TRANSMISSIONS AT VERY HIGH FREQUENCY Annual Report, 1 Sep. 1967 - 31 Aug. 1968
Eric H. Carman, Michael A. Anastassiadis, and Margaret P. Heeran Griffiss AFB, N. Y. RADC Jul. 1971 142 p refs
(Contract F61052-67-C-0003)
(AD-728714; RUAL-9; RADC-TR-71-141; AR-2) Avail: NTIS CSCL 20/14

The report contains analysis of data collected during a pilot monitoring experiment at Roma, Lesotho of 40 MHz transequatorial F-layer transmission (TEF) originating from the Greek Police network during the period September 1967 through August 1968. The analysis includes a study of diurnal and seasonal variation in both the occurrence and strength of received signal. Author (GRA)

N72-14186# Rome Air Development Center, Griffiss AFB, N.Y.
SYNCHRONIZATION AND GENERATION OF CODED SEQUENCES WITH ACOUSTIC SURFACE WAVE TECHNIQUES
Henry J. Bush Aug. 1971 46 p refs
(Job Order 45190000)
(AD-729433; RADC-TR-71-168) Avail: NTIS CSCL 09/4

The report describes in-house investigation into the implementation of pseudonoise sequences for synchronization preambles in coordinated multiple access systems. The use of and the problems in the use of maximal length sequences as the preamble is briefly described. Concern is centered about the reduction in voltage processing gain encountered when the sequences are burst correlated. The use of acoustic surface wave multiple tap delay lines to implement the waveforms is described. Particular attention is paid to metallized interdigital transducers on piezoelectric substrates. Experimental results with 70 MHz encoding and decoding devices are presented. Author (GRA)

N72-14187# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
TIME DIVISION MULTIPLE ACCESS (TDMA) EXPERIMENTATION Final Technical Report, 11 May - 10 Oct. 1970
Joshua Y. Hayase 1 Dec. 1970 39 p
(Contract DAAB07-70-C-0229)
(AD-729348; ECOM-0229-F) Avail: NTIS CSCL 17/2

The report describes an experimental computer-controlled TDMA control system which has been developed by IBM and tested through TACSAT. The in-band TDMA system is based on a concept in which a reference station generates the TDMA frame marks and disseminates them through the satellite to all participating earth terminals. The system has been designed to operate over varying frame durations (0.1 to 10 milliseconds), burst rates (1.25 through 40 megabits per second (Mb/s)) and frames that are divisible into 2, 4, 8 and 16 time slots. The system incorporates an IBM 1131-2B Central Processing Unit (CPU) and operates automatically through initial time slot acquisition to steady state burst transmission control when the assigned time slot, the number of consecutive time slots, coarse range to the satellite, burst rate etc., are specified. Closed loop test data in the form of computer printouts obtained through TACSAT link experimentation are incorporated and discussed. The experiment has amply demonstrated the feasibility of this particular method of controlling the TDMA process with a computer. In a more general sense, the advantages gained by performing computer control of digital communication processes has been demonstrated. Author (GRA)

N72-14188# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AVIONICS, COMMUNICATIONS EQUIPMENT Final Report
10 Jun. 1971 31 p
(AMCR Proj. 310-6)
(AD-729846; MTP-6-3-025) Avail: NTIS CSCL 01/3

The procedure defines methods of evaluating the performance of aircraft communications equipment. Author (GRA)

N72-14189# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
RADAR REFLECTIVITY Final Report

1 Sep. 1971 10 p
(AMCR Proj. 310-6)
(AD-729851; MTP-7-3-524) Avail: NTIS CSCL 17/9

The document provides procedures for evaluating the radar reflectivity of aircraft. Author (GRA)

N72-14190# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station
MODELS FOR RADAR DISPLAYS
Wayne Rivers 17 Jul. 1971 45 p refs
(Contract N00024-70-C-1219; Georgia Tech. Proj. A1231; Proj. S-3643)
(AD-729684; GIT-A-1231-TR-1; Task-12361) Avail: NTIS CSCL 17/9

Mathematical models are developed to describe the capability of human operators observing A, B, and PPI displays of noncoherent radars for detecting target signals in receiver noise. The models are derived from visibility data of World-War II experiments using curve-fitting techniques guided by simple physical models. The trends of performance are compatible with the predictions of detection theory, but calibration constants are assigned based upon experimentally determined human operator characteristics. Radar variables which are incorporated in the models include pulse length, receiver bandwidths, antenna beamwidth and scan rate, pulse repetition frequency, and display brightness, geometry and phosphor characteristics. Data are presented from experiments on detection of target signals in sea clutter by human operators. Author (GRA)

N72-14191# Aerospace Corp., San Bernardino, Calif.
A THREE-DIMENSIONAL RAY-TRACING METHOD FOR THE CALCULATION OF RADOME BORESIGHT ERROR AND ANTENNA PATTERN DISTORTION
M. Tavis 15 May 1971 46 p refs
(Contract F04701-69-C-0059)
(AD-729811; TOR-0059(S6860)-2; SAMSO-TR-71-210) Avail: NTIS CSCL 17/9

A technique for determining radome boresight error and antenna pattern distortion for a three-dimensional geometry is described. The technique relies on formulae developed for plain wave transmission through complex dielectric sheets modified to account for radome curvature plus a ray tracing technique applicable to a three-dimensional geometry. Numerical results are not discussed. Author (GRA)

N72-14192# RAND Corp., Santa Monica, Calif.
ON THE ACCURACY ANALYSIS OF AIRBORNE TECHNIQUES FOR PASSIVELY LOCATING ELECTROMAGNETIC EMITTERS
L. H. Wegner Jun. 1971 84 p refs
(Contract F44620-67-C-0045)
(AD-729767; R-722-PR) Avail: NTIS CSCL 17/4

Discussion of methods of locating electromagnetic emitters from airborne electronic reconnaissance systems, using passive measurements on the electromagnetic waves of the emitter taken from several locations. Measurements for finding the emitter may be either the direction of arrival at 2 or more locations along the aircraft's flight path for single-aircraft DF (direction-finding) systems, or the relative time of arrival of emitter pulses at the different aircraft locations for 3-aircraft TOA (time-of-arrival) systems. Emitter location accuracy is a function of the accuracy of these indirect measurements of the emitter location and the estimation procedure used to combine the accuracies of various measurements of location and bearing. A general expression is derived for a lower bound to the covariance matrix of the unbiased estimates of emitter location coordinates (and consequently the location CEP), using the Cramer-Rao inequality. Examples illustrate the application of the Cramer-Rao lower bound to the emitter CEP for both DF and TOA systems. Author (GRA)

N72-14193# RAND Corp., Santa Monica, Calif.
CONCEPTUAL APPROACHES IN THE DESIGN OF OPTIMAL RADAR AND SONAR SYSTEMS. 2: FORMULATION OF STATISTICAL SCATTER MODELS IN THE ELECTROMAGNETIC CASE
David Middleton May 1971 48 p refs
(Contract F44620-67-C-0045)
(AD-729762; R-707-PR) Avail: NTIS CSCL 09/4

The report continues the investigation in RM-5475 (AD-665 511) developing a statistical theory of electromagnetic wave scattering that--unlike present theory--takes account of the physical properties of the channel. The author has previously modeled signal-generated sonar reverberations in scalar fashion: however, for radar clutter, only a vector-tensorial theory can generally provide an adequate description of the scattered field. This new model uses wave theory for the detailed description of the scattered wave field, and ray theory for the macroscopic boundaries of beam patterns and scattering domains. A significant new feature is use of the weighting function of a linear, stochastic, time-varying dyadic filter. The scatteres, as well as the transmitting and receiving platforms, may be in motion that is partly random. The scattered received signal is derived, and its means and covariances are given. Author (GRA)

N72-14194# RAND Corp., Santa Monica, Calif.
SIGNAL DETECTION IN A MULTI-USER RANDOM ACCESS CHANNEL
C. C. Lovell Jul. 1971 65 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-729768; R-771-PR) Avail: NTIS CSCL 17/2

The analysis of a problem relating to the design of a hardware system to allocate channel capacity among users is discussed. This report considers an ensemble of radio signals consisting of a number of individual signals of random duration turned on and off at random times and sharing a common radio band. A general expression is developed for the autocorrelation function of the ensemble from which the optimum receiver design can be deduced by well-known methods. Numerical examples are included of the particular case of a Poisson distribution of messages having fixed duration. Results are applicable to many modern communication problems. Author (GRA)

N72-14195# Raytheon Co., Bedford, Mass.
END-FIRE RADIATION FROM PLANAR AND LARGE CYLINDRICAL ARRAYS
Giorgio V. Borgiotti and Quirino Balzano May 1971 26 p refs
(Contract F19628-70-C-0226; AF Proj. 4600)
(AD-729686; BR-6410; SR-1; AFCRL-71-0322) Avail: NTIS CSCL 09/5

End-fire radiation in planar finite arrays of circular apertures in apertures in triangular arrangement is investigated by using a technique consisting of using the results obtained via the usual infinite array model as a zeroth order approximation of a perturbation procedure. It is shown that finite arrays can be scanned up to 90 degrees from broadside, still retaining substantial radiation. The endfire radiation can be enhanced through an appropriate design of the element feed network. With minor modifications the method can be simply applied to the approximate investigation of the radiation of an array on a cylinder (having a large radius in terms of wave-lengths) in the axial direction. Author (GRA)

N72-14196# Air Force Communications Service, Richards-Gebaur AFB, Mo. Operations Research Analysis Office.
HANDBOOK FOR WIDEBAND OPERATING MAINTENANCE MANAGEMENT
R. L. Feik Feb. 1971 188 p refs
(AD-729766; AFCS-7-ORR-71) Avail: NTIS CSCL 17/2

The handbook is for use by: Commanders to aid in understanding the operation of the wideband communications system, and in focusing their attention on those critical parameters requiring personal attention; tech controllers and the operations

organizations to establish a concept and procedures to accurately assess the performance of the wideband system and to isolate degradations or faults within the system; and maintainers and the maintenance organizations to create an understanding of the more demanding functions now imposed upon tech control and to explain the necessity to greatly raise the performance demands on all the broadband equipment to maximum possible performance levels, not just to minimum Tech Order criteria.
Author (GRA)

N72-14197# Office of Naval Research, London (England).
CONFERENCE ON L'ESPACE ET LA COMMUNICATION Conference Report
Richard O. Rowlands 23 Jul. 1971 19 p refs Conf. held at Paris, 29 Mar.-2 Apr. 1971
(AD-729246; ONRL-C-6-71) Avail: NTIS CSCL 17/2

An open conference on satellite communications was held in Paris in the Spring of 1971 prior to the World Radio Conference to be held in Geneva in the Summer. The Conference served as a very good forum for uninhibited discussion and should help the official delegates at the Geneva conference to formulate good regulations governing the use of satellites for various aspects of communication. The areas that received major coverage were telecommunication, broadcasting and air traffic control.
Author (GRA)

N72-14198# California Univ., Los Angeles. School of Engineering and Applied Science.
APPLICATION OF THE VOLTERRA SERIES TO THE ANALYSIS AND DESIGN OF AN ANGLE TRACKING LOOP
Mark I. Landau Jun. 1971 185 p refs
(Grant AF-AFOSR-0699-67; AF Proj. 9749)
(AD-729889; UCLA-ENG-7130; AFOSR-71-2416TR) Avail: NTIS CSCL 17/9

The subject of the report is the analysis and design of a nonlinear feedback control system, called an angle tracking loop. A typical function of an angle tracking loop is to keep a radar antenna pointed at a target. The departure of the antenna from the target is the tracking error. This error is directly related to successful operation of the tracking device; therefore, its behavior is of interest. In this research, functional analysis techniques, namely methods associated with the Volterra series, are used to approach the angle tracking problem. For the tracker with a general polynomial nonlinearity, an arbitrary initial error and a bounded deterministic input, a method is developed for finding upper bounds on the magnitude of the tracking error (after expressing it in a Volterra series). Convergence regions of the Volterra series are also obtained. For the tracker with a general polynomial nonlinearity, a zero initial error and an input consisting of a random process (with bounded sample functions or bounded moments) in addition to a bounded deterministic function, a method is developed for finding upper bounds on the magnitude of the mean of the tracking error (after expressing it in a Volterra series). Convergence regions of the Volterra series in this case are also obtained.
Author (GRA)

N72-14199# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
CONTROL OF RADAR SCATTERING BY REACTIVE LOADING
Joseph R. Mautz and Roger F. Harrington Aug. 1971 78 p refs
(Contract F19628-68-C-0180; AF Proj. 5635)
(AD-729926; SR-13; AFCRL-71-0429; Task-563506; DoD-Element-61102F; DoD-Subelement-681305) Avail: NTIS CSCL 17/9

A method for obtaining a desired radar scattering pattern by reactively loading a conducting body is given. The theory uses the concept by characteristic modes of a loaded body. Any desired real current can be resonated by reactive loads to make it the dominant mode current of that body. If no other mode is near resonance, the radar scattering pattern becomes nearly the same as the radiation pattern of the resonated current. A quality factor Q is defined as a measure of the broadband behavior of a scatterer. Procedures for computing the real currents having a minimum Q, and maximum gain-quality ratio, are given. A pattern synthesis procedure is developed for obtaining the real current whose radiation field pattern is the least mean square approximation to a desired field pattern. The use of lumped loads to approximate continuous loading is also considered. Numerical examples and computer programs are given for each procedure discussed.
Author (GRA)

N72-14200# Northrop Corp., Palos Verdes Estates, Calif. Electronics Div.
DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Progress Report, 16 Mar. - 16 Jun. 1971
Lester A. Jeffries, (ed.) Sep. 1971 27 p
(Contract DAAB07-70-C-0110; DA Proj. 1H6-62705-A-055)
(AD-730777; ECOM-0110-5; QPR-5) Avail: NTIS CSCL 17/9

The report describes the progress which occurred during the fifth quarter of a Research and Development contract to develop a 32 x 52 resolution element digital address, thin display tube for a man-pack radar. During this quarter the design and development of photomasks for fabricating new E.S.D.-type switching plates was completed. The first full set of electroded plates was completed and assembled for bell-jar testing. A flat, rectangular all-glass envelope was designed and component parts for it were ordered. A low-power flood gun modified to reduce its thickness was readied for testing.
Author (GRA)

N72-14201# Institute for Telecommunication Sciences, Boulder, Colo. Inst. for Telecommunication Sciences.
ON THE MATHEMATICAL THEORY OF ELECTROMAGNETIC RADIATION FROM FLANGED WAVEGUIDES
A. Q. Howard 30 Jul. 1971 46 p refs
(Contract PRO-Y-71-872; AF Proj. 5635)
(AD-730292; SR-54; AFCRL-71-0418; Scientific-54) Avail: NTIS CSCL 20/14

A mathematical technique particularly suited to describing the electromagnetic radiation from open ended waveguide structures is discussed. As an example of the utility of the method, the exact solutions, for both wave polarizations corresponding to a uniform line source embedded in a dielectric filled slot in a ground plane are given. The edge condition is used to estimate and partially correct for the truncation error resulting from approximating the infinite system of linear equations by a finite one. The truncation corrected field expressions are shown to recover the proper local field behavior in the vicinity of the aperture perimeter. Some numerical results, for both aperture and radiation fields are given and in the latter case compared with the Kirchhoff approximation to the radiation field.
Author (GRA)

N72-14202# Institute for Telecommunication Sciences, Boulder, Colo. Inst. for Telecommunication Sciences.
ELECTROMAGNETIC SCATTERING OF A SMALL SPHERICAL OBSTACLE NEAR THE GROUND
David A. Hill and James R. Wait 23 Aug. 1971 22 p refs
(Contract PRO-Y-71-872; AF Proj. 5635)
(AD-730293; SR-55; AFCRL-71-0458; Scientific-55) Avail: NTIS CSCL 20/14

The field scattered by an ungrounded conducting sphere above a ground plane is considered. The quasi-static solution is facilitated by the use of bispherical coordinates. The approximate solution obtained by considering only the interaction of dipole modes with the interface is presented, for comparison. The general results are used to calculate the backscatter of a low frequency ground wave by a small obstacle.
Author (GRA)

N72-14203# SACLANT ASW Research Center, la Spezia (Italy).
A GENERAL RESULT FOR THE POWER SPECTRUM OF THE SIGNAL REFLECTED FROM THE ROUGH SEA SURFACE, AND ITS APPLICATION TO BACKSCATTER

Richard H. Clarke 1 Sep. 1971 34 p refs
(AD-730996; SACLANTCEN-TM-170) Avail: NTIS CSCL 17/1

A general formulation is given of the power spectrum of the fluctuations in the signal received by way of reflection from a rough sea surface, in terms of an arbitrary wave number-frequency spectrum of the surface waves and an arbitrary source directivity function. The formulation is specifically applied to a backscatter situation, and the extreme cases of acoustically slightly rough and very rough sea surfaces are examined in detail. The relevance of the results to experiments, to sonars and to radar-backscatter sensing of the sea surface are discussed.

Author (GRA)

N72-14204# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
THERMAL EFFECTS IN THE OPERATION OF GaAs TRANSFERRED ELECTRON MICROWAVE OSCILLATORS Interim Report
Joseph S. Bravman Griffiss AFB New York RADC Aug. 1971 167 p refs
(Contract F30602-68-C-0042; AF Proj. 5573; Job Order 55730000)
(AD-730306; RADC-TR-71-163; Task-557303) Avail: NTIS CSCL 09/5

A conceptually simple, three part methodology is applied to the understanding of thermal effects in GaAs transferred electron microwave oscillators. The results are experimentally based, but given theoretical support. The use of a basic thermal model composed of a series of lumped thermal resistances produces two important transient and steady-state temperatures; the temperature difference across the active layer, and the maximum active layer temperature. These are obtained from the input power and geometrical fabrication factors, and become the input parameters in a modification of the two-terminal device V-I characteristic. This characteristic is shown to be well described by three parameters which are obtained from an understanding by the internal diode physics. The parameters are the thermally modified peak and valley currents and low-field resistance of the diode structure. It will be shown that these three variables are sufficient to characterize the device, and when coupled to the RF circuit at the device-circuit interface, provide the desired knowledge of the observables of oscillator operation. These observables are peak and average power output, efficiency, frequency, stability, and a definition of the maximum bias and load. Author (GRA)

N72-14205# Aerospace Research, Inc., Boston, Mass.
LISTENING POST SURVEILLANCE DEVICE (LPSD) AN/PPS-14 Final Report
May 1971 137 p refs
(Contract DAAD05-69-C-0279)
(AD-730311; LWL-CR-02P69) Avail: NTIS CSCL 17/9

The Listening Post Surveillance Device (LPSD), AN/PPS-14, was developed to increase the target acquisition capability of combat riflemen under conditions of poor visibility, such as would be caused by intervening foliage, darkness, and inclement weather. The development program started first with a shorter range CW radar system, but it rapidly evolved into a Pulsed Doppler system when the performance advantages and growth potential of such a system became apparent. The basic system operates at L-band, and the nucleus of the system is an adaptive and balanced signal processor which enables the radar to cope with a high clutter background while maintaining reliable target-detection performance. Tests in Boston and Aberdeen as well as operational evaluation at Fort Hood and in Vietnam showed the radar to be an effective device for detecting targets up to 130 meters in open space, and approximately 30 to 100 meters in foliage depending upon density and wind velocity.

Author (GRA)

N72-14206# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
LINEAR-FM SPECTRA VIA A FAST FOURIER TRANSFORM ALGORITHM
Charles J. Kiss May 1971 51 p refs
(DA Proj. 1X263302-D-212)
(AD-730664; RE-TR-71-4) Avail: NTIS CSCL 17/9

The report presents the results of an investigation of the spectral characteristics of a linear-FM pulse of various time-bandwidth products. An application of a 13-bit Fast Fourier Transform algorithm to the analytic form of the linear-FM signal allows an economical spectrum computation. The spectra are investigated in an attempt to relate their ripple characteristics to the waveform's time-bandwidth product. Author (GRA)

N72-14207# Army Electronics Command, Fort Monmouth, N.J.
EXPERIMENTS WITH A NEW MESSAGE FORMAT FOR DIGITAL REPRESENTATION OF PHOTOGRAPHS Research and Development Technical Report
Bernard Lippel Aug. 1971 26 p refs
(DA Proj. 1S6-62703-A-187)
(AD-730679; ECOM-3463) Avail: NTIS CSCL 09/2

Ordinarily, a black-and-white photograph is digitally encoded in the PCM format; the picture is dissected into L square samples and the brightness of each sample is represented by a binary number of k bits. Consequently, the picture message contains k(L square) bits, including L square most-significant and exactly L square of each subsequent significance rank. With the aid of a digital computer and special picture/magnetic-tape inter-conversion equipment, experiments were performed to evaluate a radically different structure for the picture message. In effect, a k(L square)-bits message in the experimental format includes more than L square bits of some, more important, significance ranks and less than L square of other, less important, ranks. The number of brightness levels remains 2 to the k power. Pictures decoded from the experimental format were compared with pictures reconstructed from PCM-format messages having the same or larger number of bits. They seem to indicate that a well-chosen embodiment of the experimental format offers better quality than PCM under the constraints of fixed message length and fixed number of brightness levels. Photographic copies of compared pictures are included in the report. Author (GRA)

N72-14208# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Electrical Engineering.
APPLICATIONS OF INFORMATION AND SYSTEM THEORY TO AIR FORCE PROBLEMS IN COMMUNICATIONS AND DATA HANDLING Final Report, 16 Sep. 1970 - 15 Sep. 1971
J. K. Wolf 15 Sep. 1971 34 p refs
(Contract F44620-71-C-0001; AF Proj. 9749)
(AD-730349; AFOSR-71-2470TR) Avail: NTIS CSCL 09/4

The research was concerned with the detection estimation and localization of signals in noise and with coding of signals for efficient transmissions and error control. Specific topics considered include the detection and estimation of a set of harmonically related signals in noise, the detection, estimation and encoding of spatially and temporally modulated signals (including the computation of channel capacity for spatial-temporal channels), the joint optimum estimation and detection of signals in noise, the localization of a parameter to a minimum size region with preset containment probability, the algebraic decoding of signals using reliability information, a class of nonlinear codes more efficient than any known linear codes, algorithms for source coding preserving the alphabetic property of the source and bounds on the probability of overflow of finite size buffers.

Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-14209*# Texas A&I Univ., Kingsville. Dept. of Mathematics.
COMPUTER PROGRAMS AND DOCUMENTATION
F. M. Speed and S. L. Broadwater Jun. 1971 33 p
(Grant NGR-44-073-003)
(NASA-CR-115307; TR-2) Avail: NTIS CSCL 09B

Various statistical tests that were used to check out random number generators are described. A total of twelve different tests were considered, and from these, six were chosen to be used. The frequency test, max t test, run test, lag product test, gap test, and the matrix test are included. Author

N72-14210# Northwestern Univ., Evanston, Ill. Information-Processing and Control Systems Lab.
REAL TIME INFORMATION PROCESSING SYSTEMS PROGRAM Final Technical Report, 1 May 1966 - 30 Apr. 1971
Gordan J. Murphy, Max Epstein, and B. W. Jordan May 1971 34 p
(Contract N00014-67-A-0356-0003; ARPA Order 1129)
(AD-729389) Avail: NTIS CSCL 09/2

The purpose of the contract was to support research in modern electronics in Northwestern University's Information-Processing And Control (IPAC) Systems Laboratory. The program of this Laboratory initially encompassed the following areas of research: (a) Systems theory and techniques, including pulse modulation and switching, steady-state and dynamic optimization, suboptimal control, learning control, optimum nonlinear estimation and control, and computational methods for optimal control; (b) Information-Processing and computer sciences, including pattern recognition, sequential machines and automata, signal transmission and information processing in physiological systems, threshold logic, graph theory and linear group codes, analysis and optimum design of communication networks, and organizational problems of very high speed computers; (c) Physical electronics, which includes solid-state devices and gaseous electronics; and (d) Electromagnetic fields, covering coherence theory and mode coupling, boundary value problems, and reflection, scattering and antenna systems. Author (GRA)

N72-14211*# Philco-Ford Corp., Houston, Tex. WDL Div.
COMPUTER PROGRAM AND USER DOCUMENTATION MEDICAL DATA INPUT SYSTEM
J. T. Anderson 1 Nov. 1971 266 p
(Contract NAS9-11579)
(NASA-CR-115324; PHO-TN514) Avail: NTIS CSCL 09B

Several levels of documentation are presented for the program module of the NASA medical directorate minicomputer storage and retrieval system. The biomedical information system overview gives reasons for the development of the minicomputer storage and retrieval system. It briefly describes all of the program modules which constitute the system. A technical discussion oriented to the programmer is given. Each subroutine is described in enough detail to permit in-depth understanding of the routines and to facilitate program modifications. The program utilization section may be used as a users guide. Author

N72-14212*# Philco-Ford Corp., Houston, Tex. WSL Div.
COMPUTER PROGRAM AND USER DOCUMENTATION MEDICAL DATA UPDATE SYSTEM
J. T. Anderson 1 Nov. 1971 220 p
(Contract NAS9-11579)
(NASA-CR-115325; PHO-TN515) Avail: NTIS CSCL 09B

The update system for the NASA medical data minicomputer storage and retrieval system is described. The discussion includes general and technical specifications, a subroutine list, and programming instructions. K.P.D.

N72-14213*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A STORED PROGRAM CHANNEL PROCESSOR FOR CAMAC
Robert W. Bercaw 1971 7 p refs Presented at the Digital Equipment Computer Users Soc. Meeting, San Francisco, 11-13 Nov. 1971
(NASA-TM-X-67985; E-6716) Avail: NTIS CSCL 09B

A PDP-15 interface was developed for the CAMAC instrumentation standard which implements the features of both the addressable I/O bus and the single cycle data channel. The data channel section forms an independent I/O processor which executes programs stored in core. Programs consist of CAMAC commands plus special control characters and commands. Author

N72-14214*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROGRAM LISTING FOR FAULT TREE-ANALYSIS OF JPL TECHNICAL REPORT 32-1542
Paul O. Chelson 1 Dec. 1971 35 p refs
(Contract NAS7-100)
(NASA-CR-125064; JPL-TM-33-512) Avail: NTIS CSCL 09B

The computer program listing for the MAIN program and those subroutines unique to the fault tree analysis are described. Some subroutines are used for analyzing the reliability block diagram. The program is written in FORTRAN 5 and is running on a UNIVAC 1108. Author

N72-14215*# Translation Consultants, Ltd., Arlington, Va.
THE ACTIVITY OF A SOURCE OF ARTICULATION
I. B. Petyashin Washington NASA Aug. 1971 4 p refs Transl. into ENGLISH of "Aktivnosti Istochnika Rechevykh Soobshcheniy" in "Chetvetrty Simppzium po Probleme Izbytochnosti v Informatsionnykh Sistemakh" Leningrad, Acad. of Sci. /USSR/, 1970 p 495-499
(Contract NASw-2038)
(NASA-TT-F-13876) Avail: NTIS CSCL 05G

Results from an experimental study of the activity of a source of articulation and the possibility of reducing it are reported. The statistical features of juncture in the Russian language are examined, along with the effect of prolonged, artificial juncture in speech on its discrimination. Author

N72-14216*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
REQUIREMENT FOR A STANDARD LANGUAGE FOR TEST AND GROUND OPERATIONS
Joe R. Medlock 17 May 1971 26 p refs
(NASA-TM-X-67567; KSC-TR-1111) Avail: NTIS CSCL 09B

The basic requirements for a standard test and checkout language applicable to all phases of the space shuttle test and ground operations are determined. The general characteristics outlined here represent the integration of selected ideas and concepts from operational elements within Kennedy Space Center (KSC) that represent diverse disciplines associated with space vehicle testing and launching operations. Special reference is made to two studies conducted in this area for KSC as authorized by the Advanced Development Element of the Office of Manned Space Flight (MSF). Information contained in reports from these studies have contributed significantly to the final selection of language features depicted in this technical report. Author

N72-14217*# Techtran Corp., Glen Burnie, Md.
SEQUENTIAL CODING OF INFORMATION PRODUCED BY DISCRETE SOURCES WITH A FINITE MEMORY
V. N. Koshelev Washington NASA Sep. 1971 10 p ref Transl. into ENGLISH of "Posledovatel'noye Kodirovaniye Informatsii, Proizvodimoy Diskretsmi Istochnikami s Konechnoy Pamyat'yu" in "Chetverty Simpozium po Probleme Izvytochnosti v Informatsionnykh Sistemakh" Leningrad, Acad. of Sci. (USSR), 1970 p 378-387
(Contract NASw-2037)
(NASA-TT-F-13874) Avail: NTIS CSCL 09D

A scheme of sequential coding of information generated by a discrete source of the Markov type is investigated. The coding

can be carried out with an arbitrary transmission coefficient S, where S is greater than unity or less than unity, depending on whether or not it is necessary to compress the information or introduce additional redundancy to increase the reliability of transmission through the channel. The upper limits for the probability of error and the average number of operations in the case of sequential decoding are derived. Author

N72-14218*# Scientific Translation Service, Santa Barbara, Calif.
USING NATURAL AND ALGORITHMIC REDUNDANCY IN INFORMATION SYSTEMS AND AUTOMATIC CONTROL SYSTEMS
G. A. Kozlik and Yu. G. Savchenko Washington NASA Aug. 1971 12 p refs Transl. into ENGLISH of "Ob Ispol'zovanii Yestestvennoy Signal'noy i Algoritimicheskoy Izbytochnosti v Informatsionnykh i Avtomatizirobannykh Sistemakh Upravleniya" in "Chetverty Simposium po Probleme Izbytocnosti v Informatsionnykh Sistemakh" Leningrad, Acad. of Sci. (USSR), 1970 p 355-364
(Contract NASw-2035)
(NASA-TT-F-13873) Avail: NTIS CSCL 09B

The parameters of a computing system are given as a complex of control algorithms. The necessary control quality can be obtained by the proper organization of the input information, the structure of the algorithmic control system, and the computing process. Author

N72-14219*# Translation Consultants, Ltd., Arlington, Va.
INFORMATION SYSTEM REDUNDANCY AND HOW TO REDUCE IT
V. A. Atsyukovskiy Washington NASA Aug. 1971 8 p Transl. into ENGLISH of "Izbytochnost Informatsionnykh Sistem i Puti Yeye Sokrasheniya" in "Chetverty Simpozium po Probleme Izbytochnosti v Informatsionnykh Sistemakh" Leningrad, Acad. of Sci. /USSR/, 1970 p 20-29
(Contract NASw-2038)
(NASA-TT-F-13870) Avail: NTIS CSCL 05B

The need for maximum simplification of information devices, of measuring, computing, and control systems, and of conjugation units is pointed out. Evaluation of the information content of problems and of the information capacity of units is proposed. The concept of an information use factor for devices is introduced. It is shown that the mean information use factor for elements in information devices is extremely low, varying from 10 to the minus 15th power (for digital computers) to .01 (for automatic control systems). The question of simplification of the devices is raised, and several ways to simplify the devices are pointed out. Author

N72-14220# Aeronautical Research Labs., Melbourne (Australia).
A DISCRETE EVASION GAME WITH PAYOFF FOR NEAR MISS. PART 1: THE EVADER'S STRATEGY
G. J. Murray Apr. 1971 28 p refs
(ARL/Sys-Note-27-Pt-1) Avail: NTIS

Many formulations of pursuit and evasion gaming problems define the payoff as the probability with which the evader is destroyed. In an attempt to make a more realistic model for the purposes of weapons assessment, a problem is extended to allow a payoff for a near miss by the pursuer. That is, a damage criterion is specifically taken into consideration. Author

N72-14221*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PSEUDONOISE SEQUENCE GENERATORS WITH THREE TAP LINEAR FEEDBACK SHIFT REGISTERS Patent Application
Marvin Perlman, inventor (to NASA) Filed 4 Dec. 1970 14 p
(Contract NAS7-100)
(NASA-CASE-NPO-11406; US-Patent-Appl-SN-95183) Avail: NTIS CSCL 09B

A PN linear recurring binary sequence generator is described. It comprises a linear feedback shift register of r stages with three-tap feedback logic. The three stages which are fed back are i, j and r, wherein i<. The stages i, j and r are selected to correspond to the exponents of a tetranomial which includes either an (r-1)th degree or an (r-2)th degree primitive polynomial over GF(2) as a factor. The PN sequence length is (2 to the r-1 power)-1 or (2 to the r-2 power)-1 when the shift register is properly initialized. NASA

N72-14222# Dynamics Research Corp., Wilmington, Mass.
MODIFICATIONS TO ELEVATION ON AZIMUTH TRACKING PEDESTAL Final Report, 17 Feb. - 16 Jul. 1971
Robert W. Stuart 16 Jul. 1971 77 p
(Contract F19628-71-C-0140; AF Proj. 7600)
(AD-729453; R-123U; AFCRL-71-039; FY-7121-N-03188) Avail: NTIS CSCL 17/8

The report is the final report covering the modications performed on the Elevation-On-Azimuth Tracking Pedestal located at Hamscom Field. The modifications were performed in three areas: servo centering loop, slew speed increase, and addition of paper tape reader and controller. The report covers the objectives of the program, installation and operating procedures for the new hardware and the theory of operation of the modifications. Author (GRA)

N72-14223# Hamilton Standard, Windsor Locks, Conn.
USER'S MANUAL FOR PROPELLER NOISE DETECTABILITY PROGRAM Final Report, 1 May 1970 - 1 May 1971
Frank W. Barry Wright-Patterson AFB, Ohio AFAPL Jun. 1971 183 p refs
(Contract F33615-70-C-1583; AF Proj. 3066; AF Proj. 3066)
(AD-729435; HSER-5835; AFAPL-TR-71-38) Avail: NTIS CSCL 09/2

The report is the user's manual for a propeller noise detectability program written in Fortran 4 language. This program consists of ten subroutines which are to be used with the proprietary Hamilton Standard propeller performance program made available to the AFAPL previously. The noise program calculates the propeller harmonic rotational noise and the broad-band noise and compares these predicted noise levels with a selected aural detectability criterion to determine the minimum undetectable altitude. Several calculation and input data options are provided in order to enhance the value of the program to a user and are discussed in this manual. The input data and the computer output for four sample cases are presented and discussed. A listing of the source cards and a flow chart of the ten subroutines are provided. Author (GRA)

N72-14224# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TOWARD A DIFFERENTIAL GAME SOLUTION TO A PRACTICAL TWO-AIRCRAFT PURSUIT-EVASION PROBLEM IN THREE-DIMENSIONAL SPACE M.S. Thesis
S. Miles D. Williamson-Noble Jun. 1971 127 p refs
(AD-729777; GA/MC/71-5) Avail: NTIS CSCL 15/7

A practical two aircraft pursuit-evasion problem in three-dimensional space is posed as a zero sum, perfect information differential game. The purpose of the thesis is to solve this differential game and to obtain optimal or near optimal closed-loop control laws for the two players. Three models of the aircraft dynamics are used. The first model is primarily a realistic one, and as the state equations are non-linear and highly coupled, it is not possible to obtain optimal closed-loop solutions. The second model is a simplified version of the first. Using this model, the solution is carried further - the costate variables are eliminated from the controls - but closed-loop solutions still cannot be found. The third model used has different controls from the other two, but is roughly similar in nature. Optimal closed-loop controls are obtained for this model. The results obtained from these models show that the three-dimensional problem cannot be considered as a simple extension of the two-dimensional game. The necessary inclusion of the bank angle or a similar control introduces an extra order of complexity into the problem. Author (GRA)

N72-14225# Computer Sciences Corp., Falls Church, Va.
DATA TRANSMISSION NETWORK COMPUTER-TO-COMPUTER STUDY Final Technical Report
1971 157 p refs
(Contract DCA100-70-C-0009; DCA Proj. 24-6009)
(AD-729695) Avail: NTIS CSCL 09/2

The report describes the work performed as part of Task 24-6009, by CSC on a study of intercomputer communication via satellite. The study addressed the problems of designing an extremely low error rate (e.g., 10 to the -10th power) communication system for the transmission of large quantities of computer data between two remote locations. The intercomputer channel can, in general, consist of several interconnect links, between the source computer and DSCS terminal, a multiple hop satellite link and a corresponding number of interconnect links between the final satellite earth terminal and the receiving computer location. In order to satisfy the near negligible error rate requirements of the computer data, the application of forward error control techniques was investigated. The study effort includes an analysis, evaluation and recommendations for both a separate coding technique, for the interconnect links and the satellite links, and an end-to-end coding technique for the entire (cascade) channel. Author (GRA)

N72-14226# California Univ., Los Angeles. School of Engineering and Applied Science.
QUASILINEARIZATION SOLUTIONS OF DIFFERENTIAL GAMES AND EVALUATION OF SUBOPTIMAL STRATEGIES
Rollyn Gene Graham, C. T. Leondes, E. B. Stear, and A. R. Stubberud Jun. 1971 283 p refs
(Contract F04701-70-C-0240; Grant AF-AFOSR-0699-67; Proj. 9749)
(AD-729896; UCLA-ENG-71-28; AFOSR-TR-71-2412) Avail: NTIS CSCL 12/2

The first-order necessary conditions for an optimal solution are derived for a very general problem in differential games. The problem statement includes terminal constraints, control and state variable inequality constraints, multiple arc solutions, and state variable discontinuities at specified and free corners. The problems of determining optimal solutions when the strategy of the opponent is known and when the strategy of the opponent is unknown and perhaps optimal are both treated. The comparison of the performances associated with these two cases provides a measure of the efficacy of a selected, suboptimal strategy. The first-order necessary conditions constitute a multi-point boundary value problem. The quasilinearization technique is extended to handle this problem, including the effects of control and state variable inequality constraints, multiple arc solutions, and discontinuities in the state and adjoint variables. This extension of quailinearization technique requires the linearization of the equations of motions, the Euler-Lagrange equations, the inequality constraint relationships, and the discontinuity conditions. The kth and (k-1)th iterations are then shown to be related by a complicated linear operator involving the inequality and discontinuity relationships. The kth iteration is constructed from the solution of the homogeneous and nonhomogeneous forms of the linear equations. Author (GRA)

N72-14227# Philco-Ford Corp., Willowgrove, Pa. Communications and Technical Services Div.
GENERATIVE, DESCRIPTIVE, HEURISTIC, AND FORMAL MODELING IN PATTERN ANALYSIS AND CLASSIFICATION Technical Report, 3 Apr. 1969 - 4 May 1970
Laveen N. Kanal Jul. 1971 115 p refs
(Contract F33615-69-C-1571; Grant AF-AFOSR-1982-71; AF Proj. 7233)
(AD-730285; AMRL-TR-70-131) Avail: NTIS CSCL 06/4

Generative grammars and pattern descriptions have been recently associated primarily with the Linguistic School of pattern recognition research. The author shows that very similar types of generative and descriptive models are used extensively in obtaining stochastic models for patterns. The pure linguistic model is usually presented as a contrast to the pure statistical classification model. Neither pure model is relevant to applications. Rather it is hybrid linguistic-statistical approaches that have been useful in practice. The author examines the relationship of measurement analysis to pattern classification, formalisms for pattern analysis and grammatical inference, heuristic transformations for inferring pattern grammars, and the role which heuristics play in making a formalism successful. The author presents an example of the generative and descriptive modeling of error-clusters and error-gaps which occur in the transmission of binary data over digital communication channels with memory and conclude with a discussion of the testing of theories and models. Author (GRA)

N72-14228# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SUBSET-SPECIFIED SEQUENTIAL MACHINES M.S. Thesis
Tom Gordon Purnhagen Jun. 1971 129 p refs
(AF Proj. 7233)
(AD-730149; DS/EE-71-3; Task-723305) Avail: NTIS CSCL 09/2

In the design of sequential machines to perform specified tasks, situations sometimes arise in which the proper next-state or output entry in the flow-table is neither completely specified nor completely arbitrary. A machine having a flow-table of this type is called a subset-specified sequential machine (SSSM). It is not always possible to find a minimum-state realization of a subset-specified sequential machine using existing techniques for the state-reduction of incompletely-specified machines. A state-reduction procedure is developed for SSSM's which parallels the methods of Paull and Unger and of Grasselli and Luccio, and which reduces to these methods when the SSSM being reduced is an incompletely-specified machine. SSSM flow-tables are Boolean matrices, and can be manipulated as elements of a Boolean algebra. The idea of subset-specification is applicable to the modelling of certain types of learning processes, and to the analysis of systems exhibiting variable behavior or subject to uncertain inputs. Author (GRA)

N72-14229# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
DESCRIPTION OF PHYSICAL CHARACTERISTICS AND COORDINATE GEOMETRY PROGRAMS WRITTEN FOR THE HEWLETT-PACKARD 9100A PROGRAMMABLE CALCULATOR
Robert T. Haas Jun. 1971 81 p
(DA Proj. 1M2-62303-A-214)
(AD-730298; RD-TR-71-15; AMC-MS-Code-522C.11.21410)
Avail: NTIS CSCL 16/4

The report documents some programs written for the Hewlett-Packard 9100A programmable calculator. These programs can be programmed by the user from the keyboard of any Hewlett-Packard 9100. The function of these programs is to provide a fast and accurate method for defining the physical characteristics and two-dimensional coordinates of a solid of revolution of various geometrical shapes. The report also includes some programs useful in missile design. Author (GRA)

N72-14230# Army Behavior and Systems Research Lab., Arlington, Va.
EVALUATION OF MAN-COMPUTER INPUT TECHNIQUES FOR MILITARY INFORMATION SYSTEMS
Michael H. Strub May 1971 34 p refs
(DA Proj. 2Q0-24701-A-723)
(AD-730315; BESRL-TRN-226) Avail: NTIS CSCL 09/2

The publication describes the evaluation, in terms of speed and accuracy, of four configurations of procedures for inputting information into a semi-automated information processing system. Sixty USMA Prep School enlisted men were given an experimental task requiring each to translate 35 free-text messages into computer-acceptable terminology. Accuracy and speed of two input procedures were each compared under two conditions of verification. In one procedure, the subjects translated the incoming message onto a paper format before transcribing on a CRT screen (off-line). In the other procedure, the message was

transcribed directly on the CRT screen (on-line). In the unverified condition, one man performed the input operation without error check; in the verified condition, two men translated the same message, compared their translations, and resolved differences before entering the information into the data base. Performance results under the four experimental conditions were also compared with a similar 7th Army TOS procedure in which a message is translated onto a paper format and the unverified message is copied on the CRT screen by the UIOD (user input-output device) operator. Author (GRA)

N72-14231# Army Missile Command, Redstone Arsenal, Ala.
THE PEARSON'S SYSTEM OF FREQUENCY CURVES DIGITAL COMPUTER PROGRAM
N. R. Rich, L. Greene, and R. G. Graham Jun. 1971 124 p refs
(AD-730670; RD-TR-71-14; AMC-4440.15.1100) Avail: NTIS CSCL 09/2

The report describes a Fortran II digital computer program that classified a series of data as one of the three main types of Pearsons frequency curves, calculates an approximating frequency function, and applies a Chi-square goodness of fit test. The theory of the Pearson system of frequency curves and derivation of equations is also included. Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-14232# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
WIRE-BOND ELECTRICAL CONNECTIONS: TESTING, FABRICATION AND DEGRADATION: A BIBLIOGRAPHY 1957-1971
Harry A. Schafft Jan. 1972 58 p refs
(NBS-TN-593) Avail: SOD $0.60 as C 13.46:593

More than 245 papers relevant to wire-bond type electrical interconnections used in microelectronic and low-power discrete and hybrid devices are listed together with key words. The bibliographic search concentrated on compiling papers which appeared in the period from 1965 to 1970, inclusive. The selection of papers was generally limited to those that were pertinent to wire bonds where the wire diameter is less than about 2 mils and where the wire is bonded by either thermocompressive or ultrasonic means. Two indexes are provided: (1) an author index and (2) a key word index. The latter includes a tabulation of the literature citations. Author

N72-14233*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRONIC AMPLIFIERS: A COMPILATION
[1971] 25 p refs
(NASA-SP-5947(01)) Avail: NTIS CSCL 09E

Several types of amplifiers and amplifier systems are considered. These include preamplifiers, high power amplifiers, buffer and isolation amplifiers, amplifier circuits, and general purpose amplifiers. K.P.D.

N72-14234*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DETECTION OF NONLINEAR TRANSFER FUNCTIONS BY THE USE OF GAUSSIAN STATISTICS
Jack G. Sheppard Washington Feb. 1972 32 p refs
(NASA-TN-D-6642; MSC-S-261) Avail: NTIS CSCL 12A

The possibility of using on-line signal statistics to detect electronic equipment nonlinearities is discussed. The results of an investigation using Gaussian statistics are presented, and a nonlinearity test that uses ratios of the moments of a Gaussian random variable is developed and discussed. An outline for further investigation is presented. Author

N72-14235*# Scientific Translation Service, Santa Barbara, Calif.
EOLE BALLOON PROJECT. REPORT ON TESTS OF PROTOTYPE EQUIPMENT: DESTRUCTOR
J. P. Bouloumie Washington NASA Feb. 1971 14 p refs Transl. into ENGLISH of "Projet Eole ballons. Compte-rendu des essais relatifs a l'equipment de preserie: Destructeur", Natl. Center for Space Studies, Mater. and Mech. Dept., Bretigny, France, Report
(Contract NASw-2035)
(NASA-TT-F-13851) Avail: NTIS CSCL 09E

The test results of the operational destructor consisting of an electric cable detonator for destroying a valve in balloon gas bags are reported. The specifications, the results of performance checks, compatibility tests, and climatic environmental tests are presented. It is concluded that the destruction assembly is suitable for different climatic conditions, and allows rigorous control of operating characteristics. F.O.S.

N72-14236*# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE DEVICE INVESTIGATIONS Semiannual Progress Report, 1 Apr. 1971 - 1 Oct. 1971
G. I. Haddad, R. J. Lomax, N. A. Masnari, and S. E. Shabde Nov. 1971 59 p refs
(Grant NGL-23-005-183; Proj. 084000)
(NASA-CR-125072; SAPR-10) Avail: NTIS CSCL 09E

Several tasks were active during this report period: (1) noise modulation in avalanche-diode devices; (2) Schottky-barrier microwave devices; (3) intermodulation products in IMPATT diode amplifiers; (4) harmonic generation using Read-diode varactors; and (5) fabrication of GaAs Schottky-barrier IMPATT diodes. Author

N72-14237# Joint Publications Research Service, Washington, D.C.
SYNTHESIS OF S-TYPE NEURISTOR-LIKE ELEMENTS
V. P. Kotenko, S. A. Kutolin, and I. V. Stepanov 7 Jan. 1972 7 p refs Transl. into ENGLISH from Elektron. Tekh., ser. 12: Upr. Kach. (Moscow), no. 4, 1970 p 81-85
(JPRS-54878; UDC-621.315.592:542.91) Avail: NTIS

The results are presented of a synthesis of S-type elements derived from the systems Al-Si-Si3N-Al and Si-Ge-Se-Te. The method of preparing metal-insulator-semiconductor structures is explained in detail. The characteristics of the dielectric Si3N were studied, and the geometry and construction of the elements under study are presented. The preparation of switching elements with S-type characteristics was carried out by the subsequent multistage tempering method. The fabrication of film specimens was done by evaporation under heating in a vacuum or by high frequency sputtering. The switching effect in the two systems was observed in the range from 20 to 0.000001 Hz. The characteristics of the switching elements were studied both in liquid nitrogen and during the warming to 50 C. Author

N72-14238# Australian Post Office Research Labs., Melbourne.
DISTRIBUTION AMPLIFIERS, AUDIO NOTCH FILTER AND LINEAR PHASE COMPARATOR, DAP-1
I. P. MacFarlane Nov. 1970 41 p refs
(Rept-6479) Avail: NTIS

The component equipment of the DAP-1 is described. The DAP-1 provides distribution facilities for standard frequencies to instruments requiring standard frequency inputs, and for voice from automatic announcing machines, in the new Australian Standard Frequency and Time Signal Service (VNG). It also provides continuous phase comparison of the frequency standards in the VNG installation. Author

N72-14239# Sandia Labs., Albuquerque, N.Mex.
EVALUATION OF COMBINED RADIATION EFFECTS TO TRANSISTORS
B. D. Shafer and R. A. Burghard Oct. 1970 31 p refs Presented at the Ann. Conf. on Nucl. and Space Radiation Effects, Durham, N. H., 20 Jul. 1971 Sponsored by AEC
(SC-DC-713697; Conf-710709-1) Avail: NTIS

It is shown that by utilizing a comprehensive testing program, the overall response of a transistor component to radiation can be characterized in a manner which is pertinent to assuring the stability of that component. By measuring independently the neutron induced damage, the gamma ray induced damage, and the short term neutron annealing factors, the response of the devices to overall radiation can be predicted. It was further found for the devices tested, that there was no significant short term annealing of the gamma damage, and that the dose rate dependence of the gamma damage was not significant. It is also shown that utilization of multiple linear regression techniques makes it possible to determine which parameters must be controlled in order to predict the neutron induced degradation. Utilization of this technique in conjunction with a gamma ray screen makes it possible to assure the overall stability of these devices. Author (NSA)

N72-14240# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
FIELD DEPENDENT RESISTANCE AND FIELD LIMITING PHENOMENA IN SUPERCONDUCTING HIGH FREQUENCY RESONATORS Thesis - Karlsruhe Univ.
W. Kuehn Dec. 1970 238 p refs In GERMAN; ENGLISH summary
(NP-18922) Avail: AEC Depository Libraries

The behavior of lead-plated superconducting high-frequency resonators was investigated at 750 MHz over the entire range of field strengths where B is greater than zero and less than or equal to B sub C. The experimental results led to a law describing the field dependence of the surface resistance R in the form R(B) equals R(O) (1 plus K times B to the alpha power) where R(O) is the surface resistance at low field strengths and K is a constant proportional to the quality, Q sub zero at low field strengths. Independent measurements with resonators of different geometries resulted in the values of alpha greater than or equal to 2.17 and less than or equal to 2.35. NSA

N72-14241# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Lab. di Astrofisica.
FEASIBILITY STUDY FOR THE ESRO ADVANCED IMAGING DETECTOR (EAID)
L. Bartolini, A. Giangrande, and R. Habel Paris ESRO Jul. 1971 63 p refs
(Contract ESTEC-1039-70-AA)
(ESRO-CR-39) Avail: NTIS

The fundamental characteristics of the EAID permitted the performance of various tasks on both scientific and applications satellites. The properties considered relevant were storage capacity, intrinsic resolution, sensitivity, length of storage and integration times, reinforcement, and constancy. Three types of tube were considered: a PSEE camera tube, a SEC vidicon, and an ebicon. The ebicon was found to be the tube most likely to fill the requirements. Author (ESRO)

N72-14242# Army Foreign Science and Technology Center, Charlottesville, Va.
THIN FILMS IN THE TECHNOLOGY OF SUPERHIGH FREQUENCIES
22 Jul. 1971 385 p refs Transl. into ENGLISH from the Russian Monograph QD-506
(FSTC Proj. T7023012301)
(AD-728977; FSTC-HT-23-855-71) Avail: NTIS HC $6.00/MF $0.95 CSCL 09/3

A comprehensive discussion of the physics, manufacturing processes and applications of thin films in modern communications technology. The following subjects are discussed in detail: (1) Structure and properties of thin films: vacuum vaporization, cathode sputtering, thin film structure and physical properties. (2) Thin films as SHF load resistors: peculiarities of SHF resistors, material selection, behavior in an SHF field, cylindrical disc resistors for coaxial systems, flat absorption resistors for waveguide systems. (3) Use of thin film elements for power measurement at superhigh frequencies: peculiarities of such measurement, thin film bolometers, thin film thermal converters. (4) Thin film local absorbers -- absorption inserters -- for travelling wave tubes (TWT): local absorber requirements, local absorber design, a spiral conductive line with a coaxial cylindrical absorptive layer, experimental characteristics of thin film absorptive inserts for TWT's dependency of amplification and power of a TWT on physical parameters and location of a thin film absorptive insert, use of external absorbers to alter TWT amplitude characteristics, peculiarities of thin film local absorber production technology. Author (GRA)

N72-14243# Ohio State Univ., Columbus. Electro Science Lab.
ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATION SYSTEM Internal Technical Report, 15 Aug. 1970 - 15 Feb. 1971
R. T. Jr. Compton Jul. 1971 44 p refs
(Contract N00014-67-A-0232-0009)
(AD-729106; ESL-3098-1) Avail: NTIS CSCL 09/5

The report describes the progress under ONR Contract N00014-67-A-0232-0009 for the first six-month period, 15 August 1970 to 15 February 1971. The primary purpose of the work is to investigate the use of adaptive array techniques for obtaining scannable patterns from arrays as curved surfaces. During this six-month period, the electronic and RF circuitry for a 4-element array was completed, and a mockup of an aircraft fuselage with four multiturn loop antennas was constructed. Author (GRA)

N72-14244# Air Force Cambridge Research Labs., Bedford, Mass.
SHORT BACKFIRE ARRAYS
Hermann W. Ehrenspeck and John A. Strom 27 May 1971 36 p refs
(AF Proj. 4600-10-01)
(AD-729452; AFCRL-71-0368; AFCRL-PSRP-45; DoD-Element-62702F; DoD-Subelement-681000) Avail: NTIS CSCL 09/5

Short-backfire (SBF) antennas can be simply converted into highly directive and efficient array elements. Each SBF element is the equivalent of four to six dipole elements of conventional multielement arrays. Models of two-, four-, and eight-element SBF arrays have yielded gains of 17, 19, and 22 dB, respectively. Radiation patterns are presented, including the sum and difference patterns in the two major planes (E and H), as well as those for diagonal cuts at plus or minus 45 degrees. All physical dimensions are given in wavelengths so that each model can be easily scaled for any desired frequency. Author (GRA)

N72-14245# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
COHERENT DEMODULATION OF THE IMPULSE RESPONSE OF BANDPASS FILTERS
David Jaarsma Aug. 1971 32 p refs
(Contract N00014-67-A-0181-0032)
(AD-729655; TR-206) Avail: NTIS CSCL 09/5

The report contains the analysis appropriate for the complex demodulation of the impulse response of realizable lumped element filters. Plots of the time behavior of the log of the envelope, the instantaneous phase, and the instantaneous frequency, together with the conventional phase and amplitude of the transfer characteristic, are presented for a number of bandpass filters. Author (GRA)

N72-14246# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BOMBARDED SEMICONDUCTOR SHORT PULSE GENERATOR Triannual Report, 1 Dec. 1970 -

31 Mar. 1971
Aris Silzars Aug. 1971 45 p refs
(Contract DAAB07-70-C-0268; W-J Proj. 22-4083)
(AD-729361; ECOM-0268-2; Rept-22-4083-2; Rept-2; OSD-1366) Avail: NTIS CSCL 09/5

A detailed mechanical design and parts fabrication for the EBS high-current high-speed pulse amplifier have been completed. The electron gun and beam modulating structure have been tested and uniform current density at the target position has been measured. A tube without semiconductor targets has been assembled and tested for transconductance and short pulse performance. A transconductance of .0082 mhos at 4.9 kV beam potential were measured. An output pulse risetime of 1.2 ns with 80 mA of beam current was achieved at 10 kV beam potential. A complete pulse amplifier with four 1 x 2.5 sq mm targets in parallel has also been assembled. No change in diode reverse breakdown voltage characteristics was observed during cathode activation and subsequent measurements of cathode emission. Author (GRA)

N72-14247# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
STATIC ELECTRICITY DISSIPATOR Final Report
1 Aug. 1971 18 p refs
(AMCR Proj. 310-6)
(AD-729534; MTP-7-3-120) Avail: NTIS CSCL 09/1

Procedures are given for evaluating the performance of static electricity dissipators used on fixed and rotary wing aircraft. Author (GRA)

N72-14248# General Electric Co., Owensboro, Ky. Tube Div.
DESIGN, DEVELOPMENT, AND FABRICATION OF AN EIGHT INCH REMOTE VIEW DISPLAY CATHODE RAY TUBE Final Technical Report, 1 Jul. 1970 - 30 Jun. 1971
Edward T. Rate 29 Aug. 1971 104 p refs
(Contract DAAK02-70-C-0503)
(AD-729399) Avail: NTIS CSCL 09/1

The objective is to develop an eight inch, rectangular, fiber optic faceplate, cathode ray tube having an amplitude response characteristic exceeding 800 TV lines per raster height at 50 per cent response. Author (GRA)

N72-14249# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
THE DESIGN OF DEEP SUBMERGENCE HYDROPHONES Final Report
Ivor D. Groves, Jr. 3 Sep. 1971 52 p refs
(SF Proj. 11-121-302-14082; NRL Proj. S02-32)
(AD-729643; NRL-7339) Avail: NTIS CSCL 09/1

The goals and achievements in the development of a long-life, deep-submergence, wide-frequency-range hydrophone based on tried and proved designs and materials are summarized. The hydrophone has been divided into sensor, preamplifier, and cable assembly compartments to minimize failure and to facilitate construction and repair. All joints have double O-ring seals. The piezoelectric element is double-booted with butyl rubber as the water barrier. Each boot is filled with degassed, low-water-vapor castor oil. All of the exterior metal parts are covered with an elastomer to minimize corrosion and to reduce the possibility of electrical crosstalk. Fourteen different sensor elements were constructed and evaluated, and four hydrophones of one design have been constructed to give 'in-service' evaluation. The report includes a discussion of the sensor element, charts of sensitivity and directional characteristics, photographs of hydrophones and subassemblies, an assembly drawing, and a set of specifications. Data are included on elastomers and metals suitable for use at depths as great as 9000 meters. Author (GRA)

N72-14250# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MODAL INVERSION IN CIRCULAR WAVEGUIDES. PART 1: THEORY AND PHENOMENOLOGY
Gerasimos N. Tsandoulas and William J. Ince 2 Nov. 1970 9 p refs
(Contract AF 19(628)-5167)
(AD-729625; JA-3733-Pt-1-Rev; ESD-TR-71-208-Pt-1-Rev) Avail: NTIS CSCL 09/1

The work investigates the phenomenon of mode reordering in circular waveguides containing one or more dielectrics. Specifically, conditions are established, be they ranges of dimensions, dielectric constants, or frequency, under which the sequence, TM sub 01, TE sub 01, TE sub 11 and TE sub 21 is obtained instead of the conventional TE sub 11 TM sub 01, TE sub 21, and TE sub 01. The desired effect is the reversal of the order of propagation between the normally dominant TE sub 11 mode and the circularly symmetric low-loss TE sub 01. Bandwidth regimes are drawn and the credibility of the dielectric model is examined and found to be satisfactory for the application of the phenomenon to the design of digital ferrite phase shifters operating in the TE sub 01 mode. Author (GRA)

N72-14251# Naval Research Lab., Washington, D.C.
ON THE GRID STRUCTURE OF A PLANAR PHASED ARRAY
James K. Hsiao Sep. 1971 28 p refs
(AD-730025; NRL-MR-2334; Task-SF-11-141-005-13628; NRL-R02-33) Avail: NTIS CSCL 09/5

An array with a general triangular grid structure (not necessarily isosceles) is considered, and methods of generating such an array are described. An analysis of its properties is presented. It is shown that this array has a grating lobe of -6 dB relative to the main lobe. The necessary conditions to avoid grating lobes are presented, with the conventional rectangular and isosceles triangular grids included as special cases. Furthermore, it is shown that one of the grid dimensions can be extended as compared to that of an isosceles triangular grid. However, when this is done, the optimal grid area is reduced. Author (GRA)

N72-14252# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR AMPLIFIER L-BAND Triannual Report, 1 Nov. 1970 - 30 Apr. 1971
William Hershyn Aug. 1971 42 p
(Contract DAAB07-70-C-0223; W-J Proj. 22-4081)
(AD-729805; ECOM-0223-2; Rept-2; Rept-22-4081-2) Avail: NTIS CSCL 09/5

The objective of the program is to conduct experimental investigation of the design and fabrication techniques leading to the construction, testing and delivery of three experimental development model pulsed RF amplifiers which will generate 2,000 watts of peak pulse power in a 20 percent bandwidth centered at 1.3 GHz, 25 dB gain, and meet 50 percent efficiency objective. Author (GRA)

N72-14253# Rome Air Development Center, Griffiss AFB, N.Y.
GROSS LEAK HERMETICITY TESTING ANALYSIS
John R. Killelea and John P. Farrell Aug. 1971 39 p
(AD-729876; RADC-TR-71-166) Avail: NTIS CSCL 09/5

Method 1014, Seal Test, of MIL-STD-883, strictly defines the test conditions of fine and gross hermeticity testing as they pertain to microcircuit packages. The gross leak tests of Method 1014 and the following two procedures are described and evaluated in this report: (1) Weight Test, and (2) Electronic Leak Detection. Primary areas of interest which are covered include the sensitivity and repeatability of each test; susceptibility to destruction; the effect of package constructions; and test selection criteria. Completion of this effort has allowed the revision of Method 1014. The primary intent of this report is to provide a supplemental, documented guide to both microcircuit manufacturers and Air Force contractors engaged in screen testing and device procurement, concerning the subject Seal Test contained in MIL-STD-883. Author (GRA)

N72-14254# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
SILICON RF POWER TRANSISTOR METALLIZATION Final Report, 6 Jul. 1970 - 31 May 1971
Edward L. Hall Oct. 1971 112 p refs
(Contract DAAB07-70-C-0164; DA Proj. 1H6-62705-A-056)
(AD-730774; L-58; ECOM-0164-F; Task-01; Subtask-35) Avail: NTIS CSCL 09/1

The effects of high temperatures and high current densities on the physical properties of aluminum metallization on semiconductor devices were studied. In particular, this research was concerned with three possible failure modes of the metallization; electromigration, interdiffusion of silicon and aluminum, and metallization reconstruction due to thermal cycling. Electromigration theories are discussed and an engineering curve predicting MTF for an Al-2% Cu alloy was obtained.
Author (GRA)

N72-14255# Texas Western Coll., El Paso. Schellenger Research Lab.
FUNDAMENTALS OF CAPACITOR MICROPHONE DESIGN
Harold N. Ballard, George Q. Clark, Donald K. McCarty, and Aurora Villegas 1971 45 p refs
(Contract DA-29-040-ORD-1237)
(AD-730760) Avail: NTIS CSCL 09/1

The report discusses: Basic relationships used as a guide in the microphone design; The reciprocity method for microphone calibration; The design, calibration, tests and modification of the capacitor microphone; Comparison of various microphones (capacitor, ceramic, crystal) with regard to frequency response and ability to reproduce wave form. Author (GRA)

N72-14256# Dayton Univ., Ohio. Research Inst.
PRESSURE RECIPROCITY CALIBRATION OF CONDENSER MICROPHONES IN 100 PERCENT HELIUM AT VARIOUS ATMOSPHERIC PRESSURES
L. Keith Kettler Wright-Patterson AFB, Ohio AMRL Jul. 1971 30 p refs
(Contract F33615-69-C-1260; AF Proj. 7231)
(AB-730909; UDRI-TR-71-10; AMRL-TR-71-23; Task-723104) Avail: NTIS CSCL 09/1

Four condenser type microphones (W. E. Type 640AA and B and K Type 4131) were calibrated in a 100% helium atmosphere using the pressure reciprocity calibration method. This calibration was performed at three different atmospheric pressures, ranging from 739 mn Hg to 257.5 mn Hg. This test was in support of a research study of the effects of helium on the ability to generate speech. Findings of the study indicate that the sensitivities of the microphones were only slightly reduced in helium compared to air. An average decrease in sensitivities of 0.5 db or less was observed over the test frequency range of 100 to 4000 Hz when compared with the associated normal air sensitivities. Author (GRA)

N72-14257# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISCHARGERS, 500kV
V. P. Savelyev and A. I. Bronfman 28 Jul. 1971 22 p refs Transl. into ENGLISH of Izd-vo Energiya, Moscow, 1964 p 177-184
(AD-730367; FTD-MT-24-88-71; DIA-Task-T70-01-03; DIA-Task-T70-02-01) Avail: NTIS CSCL 09/3

The article deals with 500 kilovolt discharges, but especially magnetic-gate discharges. It brings to light some information about the development and research of new spark gap designs, in which the arc of an accompanying current is extinguished (suppressed) with the help of a magnetic field. The article also covers such topics as: permissible voltage in a discharger from the overheating conditions of shunting resistors; the greatest permissible voltage suppression voltage in a discharge during atmospheric surges and switching surges; the pulse breakdown voltage of a discharger; remaining voltage; the transmission ability of resistor plates and spark gaps. Author (GRA)

N72-14162# Joint Publications Research Service, Washington, D.C.
UNIJUNCTION TRANSISTORS AND THEIR POSSIBLE APPLICATIONS
A. K. Grebnev, A. I. Krivonosov, and V. I. Ruslanov *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 9-18 refs (See N72-14160 05-07)
(UDC-629.7.051:621.396.6.001) Avail: NTIS

N72-14163# Joint Publications Research Service, Washington, D.C.
A MICROWAVE SWITCH BASED ON THIN FERROMAGNETIC FILM
P. A. Puzyrev and Yu. I. Voloshchenko *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 19-29 refs (See N72-14160 05-07)
(UDC-629.7.051:621.37.001) Avail: NTIS

N72-14164# Joint Publications Research Service, Washington, D.C.
A STUDY OF ANTENNAS WITH FREQUENCY BEAM SCANNING
D. B. Zimin and V. S. Losev *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 30-68 refs (See N72-14160 05-07)
(UDC-629.7.051:621.396.6.001) Avail: NTIS

N72-14166# Joint Publications Research Service, Washington, D.C.
CALCULATION AND DESIGN OF DIODE SWITCHING DEVICES IN THE DECIMETER RANGE
G. F. Vasilyev, Yu. A. Yevdokimenko, and V. N. Ginzburg *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 81-100 refs (See N72-14160 05-07)
(UDC-629.7.051:621.396.6.001) Avail: NTIS

N72-14167# Joint Publications Research Service, Washington, D.C.
A STUDY OF SOME CHARACTERISTICS OF DIODE SWITCHING DEVICES IN THE DECIMETER RANGE
G. A. Bukhonina, G. F. Vasilyev, V. A. Galkovskiy, I. Ye. Golberg, and V. N. Ginzburg *In its* Nonlinear and Microwave Radio Eng. Systems 22 Dec. 1971 p 101-128 refs (See N72-14160 05-07)
(UDC-629.7.051:621.396.6001) Avail: NTIS

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-14258 Northwestern Univ., Evanston, Ill.
PARTIAL AND GROUP DECOUPLING IN MULTIVARIABLE CONTROL THEORY Ph. D. Thesis
Stephen Masao Sato 1970 93 p
Avail: Univ. Microfilms Order No. 71-1960

The concepts of partial and group decoupling by state variable feedback are examined, using extensions of decoupling in multivariable control systems. These extensions are made by decoupling the subsets of the output set. The decoupling in both cases will be achieved by using a state-variable feedback matrix F and a nonsingular (m x m) input matrix G, and will be called m-input decoupling (MID) and m-input group decoupling (MIGD), respectively, to reflect the restrictions on the input matrix G. An algorithm, developed by Silverman for constructing inverse systems, is utilized to obtain necessary and sufficient conditions for the problems of MID and MIDG. Finally, the partial and

group decoupling results are used to develop an approach to designing dynamic controllers for decoupling a system. Examples are given illustrating the results. Dissert. Abstr.

N72-14259 Texas Univ., Austin.
A MODIFIED SWEEP METHOD FOR CONTROL OPTIMIZATION Ph.D. Thesis
Daniel Colunga 1970 125 p
Avail: Univ. Microfilms Order No. 71-112

A modified successive sweep methods was devised which yields Eulerian solutions to two-point boundary value problems of control optimization. This was accomplished by requiring control satisfaction of local optimality over the entire time interval of interest, while simultaneously relaxing terminal transversality requirements on the Lagrange multipliers. The new method was tested successfully on several classes of problems, including optimization of the roll program for an Apollo-type three-dimensional reentry trajectory to minimize a time integral of spacecraft heating and acceleration. This method was shown to require significantly less computer storage than the original successive sweep method, while requiring numerical integration of fewer variables. In addition, the method was shown to possess rapid terminal convergence and conjugate point test capability. Dissert. Abstr.

N72-14260# Eidgenossische Technische Hochschule, Zurich (Switzerland).
FINAL VALUE CONTROL OF LINEAR PROCESSES Ph.D. Thesis
Bernardo Ferroni 1970 107 p refs In GERMAN; ENGLISH summary
(Diss-4471) Avail: NTIS

Finite settling time control of linear, time-invariant, scalar processes with known parameters but unknown initial conditions were investigated. Initial conditions causing unsatisfactory transient response can occur in connection with machine tools, cranes with hanging loads, aircraft, and space vehicles. Conventional control theory deals with identified systems in an initial steady state. Finite settling time control using the method of digital compensation may lead to control systems with a great sensitivity with respect to the initial conditions, since compensation artificially introduces uncontrollable modes in the control loop. A new method is presented for implementing the finite settling time control for sampled data systems with unknown initial cofditions. This is an extension of conventional systems with output feedback; it generates a null-potency transition matrix for the overall system by iterative estimation and linear combination of the state variables. Author

N72-14261# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ADAPTIVE DESIGN OF A CLASS OF ELECTRICAL NETWORKS USING MATHEMATICAL OPTIMIZATION Ph.D. Thesis
Nanda Dulal Nandi 1970 190 p refs
(Diss-4518) Avail: NTIS

An adaptive synthesis of a low pass filter incorporating nonideal elements with unequal dissipation factors is considered, in an attempt to meet or exceed attenuation specifications in the pass and stop bands without violating practical limits placed on the filter elements. The problem is formulated as a general nonlinear programming problem, in which a nonlinear objective function, subject to linear and nonlinear inequality constraints, is minimized using a penalty function technique. Minimizations were carried out iteratively on a high speed digital computer using the method of steepest descent and a one-dimensional search procedure. For nonconvex optimization problems with a large number of local optimal solutions, the best possible local solutions are obtained independently while working with different sets of initial values of the parameter vector. The resultant minimum values of the objective functions are shown to be almost identical. The algorithm was also applied to adaptive synthesis of allpass filter networks. Author

N72-14262*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ECLECTIC INTEGRATED CIRCUIT RELIABILITY MODEL
Barnett C. Fetcher 1 Jan. 1972 84 p refs
(Contract NAS7-100)
(NASA-CR-125062; JPL-TM-33-514) Avail: NTIS CSCL 09C

A general form of a comprehensive reliability modeling rationale was formulated for the integrated circuit. Integrated device failure models amenable to long term applications were investigated. Author

N72-14263# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STABILITY OF HIGH INTENSITY ELECTRON BEAM
Kazunari Ikuta Nov. 1971 13 p refs
(IPPJ-115) Avail: NTIS

A stability condition is obtained for a general configuration of a high intensity neutralized electron beam and is applied to cylindrical beam systems. Neutralized cylindrical beam systems are stable if the total beam current sufficiently exceeds 10,000 ampere. Author

N72-14264# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE LIMIT OF MASSIVE ELECTRODYNAMICS
S. Deser Oct. 1971 10 p refs
(LPTHE-71/50) Avail: NTIS

A simple derivation of the limit to Maxwell theory of massive electrodynamics is given, exhibiting the transformation of the longitudinal mode into a scalar field decoupled from the current. It is noted that this field remains coupled to gravitation, however. Author

N72-14265# Sandia Labs., Albuquerque, N.Mex.
MODELING AND RADIATION EFFECTS STUDY OF AN LSI/MOS LOGIC SYSTEM
D. H. Habing and B. D. Shafer Jul. 1971 51 p refs Sponsored by AEC
(SC-DR-710423) Avail: NTIS

A comprehensive modeling and radiation effects study of p-channel LSI/MOS test chips was performed. Ionization and neutron effects were experimentally determined for each of the model parameters. The usefulness of the model, which contained the basic Sah equations modified to include channel length modulation, body effect and electron field dependent channel mobility terms, was then demonstrated in device characteristic and circuit response predictions. Author (NSA)

N72-14266# Iowa Univ., Iowa City. Dept. of Mathematics.
A DESIGN TECHNIQUE FOR FAULT LOCATABLE SWITCHING CIRCUITS
Sudhakar M. Reddy Jun. 1971 24 p refs
(Contract N00014-68-A-0500; Grant NSF GK-10025; Proj. 432)
(AD-729267; TR-41) Avail: NTIS CSCL 09/2

A method to design completely fault locatable combinational switching circuits is proposed. The networks that are obtained by the proposed designs require less hardware and are also easier to test than two level realizations. Author (GRA)

N72-14267# Army Foreign Science and Technology Center, Charlottesville, Va.
THE USE OF INTEGRAL EQUATIONS IN CALCULATING PERIODIC REGIMES IN NONLINEAR CIRCUITS
E. A. Karpov 26 Aug. 1971 13 p refs Transl. into ENGLISH from Teor. Elektrotekhn. (USSR), no. 5, 1968 p 107-112
(AD-729586; FSTC-HT-23-449-71; ACSI-J-9520; T702301-230) Avail: NTIS CSCL 09/5

The subject of the present paper is the calculation of an electric circuit with a single nonlinear element, based on piecewise-linear approximation of the characteristics of that element. The calculation is based on the data supplied by Ye. N.

Rozenvasser, whose studies have been devoted to the use of integral equations in the analysis of nonlinear systems.
Author (GRA)

N72-14268# Illinois Univ., Urbana. Coordinated Science Lab.
ON THE DESIGN OF DIAGNOSABLE COMBINATIONAL NETWORKS
Michael Reid Paige Jul. 1971 144 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-15459)
(AD-730117; R-519; UILU-ENG-71-2222) Avail: NTIS CSCL 09/1

A vector notation for the generation of fault detection tests from the functional description of a logic network is introduced. It is shown that it is possible to treat the fault behavior and diagnosis of the basic gate types (AND, OR, NAND, NOR) in a uniform manner and to extend this approach to two-level designs. The formulation of a design criterion to simplify the fault detection problem in multi-level logic networks is studied. The simplification sought is two-fold: The network should be a priori completely diagnosable, that is, all single and multiple faults can be detected; all the information pertaining to the diagnosis of the network can be obtained from the functional description of the element. It is shown that the criterion of network irredundancy satisfies the above requirements, while being a reasonable design tool. The use of a higher-level system design language for the specification of digital networks is examined. Some general properties which are desirable in such a system to enhance the diagnosability of the resulting design are discussed. A method for translating a design description into diagnosable hardware is presented. Author (GRA)

N72-14269# California Univ., Los Angeles. School of Engineering and Applied Science.
AUTOMATED DESIGN OF FEEDBACK CONTROL SYSTEMS
John A. Page Jun. 1971 206 p refs
(Grant AF-AFOSR-0699-67; AF Proj. 9749)
(AD-729891; UCLA-ENG-7136; AFOSR-71-2411TR) Avail: NTIS CSCL 12/1

The conventional design of miltiloop control systems is a tedious, time consuming task. If a digital computer is used to assist in this design process, the engineer's work is somewhat lessened. Therefore, the complete, automated design of such a multiloop system is very desirable. The report studies the problem of automating the design of a multiloop feedback control system. In particular, frequency domain specifications are first combined into a nonlinear cost functional. Then the functional is minimized using mathematical programming (functional minimization) techniques. This approach determines compensator parameters which force the system to satisfy the specifications. Author (GRA)

N72-14270# Iowa Univ., Iowa City. Dept. of Mathematics.
A COMPLETE TEST SET FOR QUASI PRIME IMPLICANT NETWORKS
Benjamin M. Lin and John P. Robinson Aug. 1971 19 p refs
(Contract N00014-68-A-0500)
(AD-730780; TR-46) Avail: NTIS CSCL 09/5

A procedure to specify a nearly minimum complete test set for quasi prime implicant networks is given. In this procedure, only the derivation of a 0-test set is needed. The technique via self-dual function imbedding aims at generating easily testable network realizations for logic functions. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-14271 Polytechnic Inst. of Brooklyn, N.Y.
SLINGSHOT: EXPERIMENTAL AND ANALYTICAL PERFORMANCE Ph.D. Thesis
Joseph Librizzi 1970 114 p
Avail: Univ. Microfilms Order No. 70-26079

An experimental and theoretical investigation was performed leading to the development of the advanced aerodynamic test facility, Slingshot. The basic concept involves accelerating a slug of test gas and passing it over a fixed model, in an attempt to obtain a very high velocity, high Reynolds number environment without the use of a preprocessed test gas. Inherent problems are booster simplicity, nontrivial test times, test gas vehicle debris removal, and internal sloshing of the test gas during acceleration. A relatively simple configuration was built using a light-gas-gun-driven plastic capsule in a barrel. A 15-degree half-angle cone was used as the experimental model. The state of the test gas was investigated theoretically to determine the wave behavior and possible shock formation in the capsule during acceleration. A study was also made of various acceleration histories and barrel-capsule lengths in the study of the development of higher performance facilities. Dissert. Abstr.

N72-14272# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
INFRARED SUPPRESSION DEVICES Final Report on Materiel Test Procedure
1 Sep. 1971 19 p refs
(AMCR Proj. 310-6)
(AD-729603; MTP-7-3-523) Avail: NTIS CSCL 14/2

The report describes test methods and techniques for evaluating infrared suppression devices and determining their effectiveness for suppressing or masking aircraft infrared emissions. GRA

N72-14273# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INTERMEDIATE ACTIVITY LEVEL TOWER CAB EVALUATION, PHASE 2 Final Report, Jul. - Sep. 1971
J. Roy Bradley, Jr. Dec. 1971 47 p
(FAA Proj. 144-170-06X)
(FAA-NA-72-2; FAA-RD-71-104) Avail: NTIS

Air traffic controllers acceptance of an intermediate activity level, airport traffic control tower, proposed for construction on a national basis, was investigated. Full-scale mockups of the tower cab and associated junction room were constructed and equipped with operational equipments. A 2 week evaluation was conducted with participation by air traffic control specialists. Results indicate that the proposed tower would be highly acceptable from an operational, as well as an environmental standpoint. Concern was expressed over the large size of tower cab corner posts and window mullions and over unknown factors relative to the adequate performance of the heating, ventilating, and air conditioning system. Numerous suggestions for both local and national application were determined and documented. Author

N72-14274*# McDonnell Aircraft Corp., St. Louis, Mo.
AN INVENTORY OF AERONAUTICAL GROUND RESEARCH FACILITIES. VOLUME 4: ENGINEERING FLIGHT SIMULATION FACILITIES
C. J. Pirrello, R. D. Hardin, L. P. Capelluro, and W. D. Harrison

Washington NASA Nov. 1971 160 p 4 Vol.
(Contract NAS2-5458)
(NASA-CR-1877) Avail: NTIS CSCL 14B

The general purpose capabilities of government and industry in the area of real time engineering flight simulation are discussed. The information covers computer equipment, visual systems, crew stations, and motion systems, along with brief statements of facility capabilities. Facility construction and typical operational costs are included where available. The facilities provide for economical and safe solutions to vehicle design, performance, control, and flying qualities problems of manned and unmanned flight systems. Author

N72-14275# Princeton Univ., N.J. Plasma Physics Lab.
LEVITATED RING IN FM-1
J. W. Willard, J. File, and G. D. Martin Jul. 1971 9 p refs Presented at the 4th Symp. on Eng. Probl. of Fusion Res., Washington, D.C., 20 Apr. 1971
(Contract AT(30-1)-1238)
(MATT-842; Conf-710418-19) Avail: NTIS

The ring was successfully levitated in the slide unstable mode in the FM-1 Machine. The magnet, wound of 4221 turns of 90 mil RCA NB3Sn ribbon, has a current capacity of 375,000 ampere turns. The coil is charged inductively or by external power supply, and is housed in a seven inch-minor-diameter toroidal Dewar with external connections for filling, venting, and charging under high vacuum. Test results of quench temperature vs. current for isochoric life of the ring at full current is approximately one hour. This coresponds to 10.7 K at 25 atmospheres. Author (NSA)

N72-14276# Institute of Nuclear Research, Warsaw (Poland).
SILICON PULSE CHAMBER FOR MEASUREMENTS OF X AND GAMMA DOSE RATE
Mieczyslaw Slapa, Eugeniusz Belcarz, Janina Chwaszczewska, Witold Gruzdz, and Wladyslaw Szymchyk 1971 26 p refs
(INR-P-1304) Avail: AEC Depository Libraries

A possibility of improving the energy response of the X and gamma silicon dosimeter by integrating the charges and the number of individual pulses was investigated. The energy response depends strongly upon the value of the discrimination level, E sub d. The best results have been obtained for the discrimination level E sub d equal to 25 keV using a 0.8 millimeter thick copper corrective filter. The energy response is constant within plus or minus 5 percent for E less than or equal to 180 keV and within plus or minus 30 percent for E sub gamma greater than or equal to 55 keV and less than 180 keV. For the discrimination level E sub d equal to 50 keV the energy response is constant within plus or minus 7 percent for E sub gamma equal to or greater than 280 keV. The dose rate sensitivity for an active volume of 36 cubic millimeters may be ranged between 1 m R/h and 20 R/h f.s.d. Author (NSA)

N72-14277# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
SHOCK TUBE SIMULATION OF ENTRY STAGNATION CONDITIONS IN PLANETARY GASES
M. J. Lewis Sep. 1971 44 p refs
(VKI-TN-77) Avail: NTIS

An inverse analysis is presented which evaluates the performance and simulation capabilities of any shock tube. This approach can be applied only if the relevant real gas tables are available for the test gases and the performance envisaged. Theoretical performance curves are presented for the piston-driven shock-tube with argon, air, or a mixture of 90% CO2 and 10% N2, as test gases. Attitude-velocity curves are presented for the planets Earth, Mars, and Venus. These graphs illustrate the range of entry-vehicle stagnation-conditions which may be achieved with this shock tube when the following testing regions are employed: the region behind the incident shock, the reflected shock region, or the stagnation region of a model mounted in the shock tube. Author (ESRO)

N72-14278# Royal Aircraft Establishment, Farnborough (England).
STAR SENSOR TEST FACILITY AT THE RAE
B. Hollaway May 1971 20 p ref
(RAE-TR-71091) Avail: NTIS

A test facility for the evaluation of star sensors is described consisting of an astronomical observatory and a star simulator laboratory. The observatory contains a telescope with which it is possible to find stars down to visual magnitude +4 in daylight, and stars down to visual magnitude +14 at night. In the star simulator laboratory, stars of approximately A sub 0 class in the magnitude range +2 to +7 can be simulated, and, superimposed on a simulated sky in the luminance range 250 to 2500 candelas per square meter; the star can be also scanned from side to side through angles of up to +1 degree at rates up to 750 arc seconds per second. Author (ESRO)

N72-14279# ARO, Inc., Arnold Air Force Station, Tenn.
ICING TEST CAPABILITY OF THE ENGINE TEST FACILITY PROPULSION DEVELOPMENT TEST CELL J-1 Final Report, 13 Nov. 1969 - 31 Oct. 1970
E. S. Gall and F. X. Floyd AEDC Aug. 1971 60 p refs
(Contract F40600-72-C-0003; ARO Proj. RJ2040; ARO Proj. RJ0053)
(AD-729205; AEDC-TR-71-94; ARO-ETF-TR-71-52) Avail: NTIS CSCL 21/5

The propulsion development test cell (J-1) has been modified to test turbine engines, with airflows up to 1200 lb/sec, in altitude icing conditions. Uniform ice distributions were obtained in the plane of the simulated icing cloud from 0.3 to 4.0 gm/stere, where a stere is defined as one cubic meter. Water droplet size was varied from 19 to 28 microns (mean volumetric diameter) with the present spray nozzles, and this range can be extended by changing spray nozzles. The holography system used to determine water droplet size is a state-of-the-art advancement in obtaining these data. The droplet data were obtained in a sample, 2 in. in diameter and 3 ft long, without disturbing the airstream. The hologram containing these data is reconstructed. The droplet size and number were determined electronically so that icing data were available within hours after the test period. Author (GRA)

N72-14280# Air Force Special Weapons Center, Kirtland AFB, N.Mex.
DEVELOPMENT OF A FIVE INCH DIAMETER, MACH 6.0, MONORAIL, ROCKET SLED
Daniel J. Krupovage Feb. 1971 36 p refs
(AD-729208; AFSWC-TR-71-7) Avail: NTIS CSCL 14/2

A five inch diameter monorail rocket sled was designed, fabricated and tested at the Test Track Facility at Holloman Air Force Base. The vehicle was designed to allow easy replacement of appendages which were subject to severe aerodynamic heating and/or high wear rates. The monorail vehicle as described was shown to be capable of reaching 6800 feet per second and of being recovered on the track. Drag coefficients up to Mach 6.0 were obtained and are presented in this report. Author (GRA)

N72-14281# Naval Ordnance Lab., White Oak, Md.
EXPLOSION PRODUCT DISPOSITION IN THE CONICAL SHOCK TUBE
Joseph G. Connor, Jr. 22 Jul. 1971 53 p refs
(NA Proj. 007/05-Prob-101)
(AD-729670; NOLTR-71-134) Avail: NTIS CSCL 14/2

A series of 300 gm pentolite charges has been fired in the NOL 180-ft conical shock tube (CST). Parameters examined were: drag force on a cylinder exposed side-on to the flow, temperature at a thermocouple inserted through the wall, opacity to visible light near the wall, side-on overpressure at the wall, and luminosity in the firing chamber. Dust left on the walls from previous firings is lifted into a boundary layer by a succeeding shot. The result is a distortion of dynamic pressure from the anticipated smooth decay. There appears to be two slugs of hot

gas moving down the tube behind the blast front. These mix, cool, and become indistinguishable about half-way down the tube. Photographs of firing chamber luminosity strongly imply a turbulent boundary layer choke near the muzzle. Side-on overpressure records contained no surprises relative to previous work at similar gage locations. Author

N72-14282# California Univ., Los Angeles. Dept. of the Aerospace and Mechanical Engineering Sciences.
ABSOLUTE INFRARED INTENSITY MEASUREMENTS ON METAL OXIDES Final Report, 1 Jul. 1970 - 30 Aug. 1971
K. G. P. Sulzmann and S. S. Penner 30 Aug. 1971 24 p refs (Contracts N00014-69-A-2000)
(AD-729683) Avail: NTIS CSCL 14/2

Absolute infrared intensity measurements are to be performed on metal oxides produced in situ in shock tubes behind reflected shock waves by chemical reactions between volatile gaseous constituents. Infrared measurements refer to the 8 to 15 micron region on vibration-rotation bands belonging to metal oxides. The initial investigations are to be performed on FeO formed in Fe(CO)5-O2-Ar mixtures at temperatures between 1500 and 3000K. The report describes the shock tube facility, gas mixing system, ultraviolet and visible spectrometer, and the infrared radiometer to be used. GRA

N72-14283# Army Natick Labs., Mass. Earth Sciences Lab.
ENVIRONMENTAL GUIDE FOR ARCTIC TESTING ACTIVITIES AT FORT GREELY, ALASKA
Richard D. Sands, Howard L. Ohman, and Fred J. Sanger May 1971 95 p refs Prepared in cooperation with Army Cold Regions Research and Engineering Lab., Hanover, N. H.
(DA Proj. 1T0-62112-A-129)
(AD-729350; ES-69; USA-NLABS-TR-70-54-ES) Avail: NTIS CSCL 14/2

The physical environment of the Fort Greely area is analyzed and evaluated with special reference given to the significance of climate, terrain, and vegetation on testing activities at the various courses and ranges of the test site. Cold spells under -25 and -40F are studied for their frequency and duration of occurrence at the test areas. It is shown that there is considerable variation in minimum temperature within the area, with Bolio Lake, for example, often being 10 to 15F colder than the main weather station. Differences within one mile may be as great as 40F on some calm, clear winter nights. Even under these conditions, however, temperatures suitable for cold testing are not reached on very many nights, and a temperature of -70F, the design temperature given in Army Regulation 70-38 for extreme cold, has never been attained. The change of a minimum of -25F, the uppermost temperature acceptable for cold tests, is only one in fifteen for any given date between 13 November and 18 March at the main station. Visibility restrictions such as ice fog, blowing dust, and snow are occasionally present during the winter season. Solar and lunar illuminations are discussed and a table of the phases of the moon through 1980 is presented. Author (GRA)

N72-14284# Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
MATHEMATICAL MODELS OF VEHICULAR DYNAMICS
C-P. Kuo Aug. 1971 21 p refs
(Contract DAAF03-69-C-0014; Proj. Themis)
(AD-729402; THEMIS-UI-37) Avail: NTIS CSCL 13/6

A general survey of the effects of the suspension, tire and external loading (engine, road roughness and wind) on vehicle vibration is presented. Models with one, two, four and six degrees of freedom are compared and discussed. A seven degree model including sprung and unsprung masses is presented and analyzed based on Newtonian mechanics. A model with 15 degrees of freedom is presented for the tank. Author (GRA)

N72-14285# Air Force Academy, Colo. Frank J. Seiler Research Lab.
ANNUAL DESCRIPTIVE BROCHURE Basic Research Achievements, Apr. 1964 - Jun. 1971
Harold Beck and Milton D. Sprinkel 1 Jul. 1971 109 p refs
(AF Proj. 7903; AF Proj. 7904; AF Proj. 7905)
(AD-729219; DRS-61102F; BPAC-681303; BPAC-681304; BPAC-681307) Avail: NTIS CSCL 05/2

The Frank J. Seiler Research Laboratory was established at the United States Air Force Academy to conduct research with a full time staff in chemistry, applied mathematics and aerospace mechanics, to provide a means for supporting faculty research in those areas of interest to the United States Air Force, and to foster and encourage scientific research among cadets. The purpose of this booklet is to help you become better acquainted with this AFSC Basic Research Laboratory, especially the people and their work. Frank J. Seiler Research Laboratory's activity meshes closely with the current academic program at the USAF Academy, but the Laboratory also continually seeks new ways to relate its research to future capabilities for the Air Force. Toward this end the scientists work closely with members of many governmental, academic, and industrial institutions.
Author (GRA)

N72-14286# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
COMPARISON OF PERFORMANCE OF EXPERIMENTAL MEMBRANES, NONSKID COMPOUNDS, ADHESIVES, AND EARTH ANCHORS WITH REGARD TO C-130 AIRCRAFT OPERATIONAL REQUIREMENTS Final Report, Oct. 1966 - Aug. 1969
Timothy W. Vollor Aug. 1971 184 p refs
(DA Proj. 1T0-62103-A-046)
(AD-729803; AEWES-TR-S-71-11) Avail: NTIS CSCL 01/5

Laboratory and field tests were conducted at the U. S. Army Engineer Waterways Experiment Station (WES) to evaluate experimental membranes and materials that showed promise of improving the performance of membranes used to surface assult-type airfields for operations of C-130 aircraft. Eleven membranes were evaluated during this investigation. The adhesives submitted were one-part adhesives composed of a synthetic rubber resin dispersed in a solvent. The minimum requirements for evaluating the adhesives were the minimum values obtained from tests conducted with the G580-25 adhesive, which has been accepted previously for use with the T17 membrane. Twelve commercial nonskid compounds were submitted to the WES for evaluation. These nonskid compounds were evaluated using simulated C-130 operations. Four anchor types, i.e., the guy, disk-type, two-legged, and arrowhead anchors, were evaluated to determine which would be the most suitable for use with membrane-surfaced assualt airfields. The durability and holding strength of each anchor were evaluated.
Author (GRA)

N72-14287# Air Force Systems Command, Edwards AFB, Calif.
AIR-AUGMENTED ROCKET PROPELLANT SCREENING FACILITY Summary Report, 15 Feb. 1969 - 1 Jan. 1971
Charles H. Hitchcock, Thomas K. Henry, and Edwin J. Soterpoulos Ju.. 1971 191 p refs
(AF Proj. 314804IMC)
(AD-729884; AFRPL-TR-71-73) Avail: NTIS CSCL 14/2

The report summarizes the results of an Air Force Rocket Propulsion Laboratory engineering development effort to design, fabricate and activate a laboratory-scale, direct-connect test facility. The facility, composed of a clean air supply system, a primary solid rocket combustor and a ramburner, is designed to support air-augmented rocket propellant development efforts. The versatile facility design allows variation in hardware configuration and propellant flow parameters to simulate a broad range of flight conditions, i.e., Mach No. 2 to 3.5 and altitudes from sea level to 50,000 feet. The air delivery system is designed for maximum conditions of 7 lb/sec, 1000F and 250 psia. The annular inlet manifold is adaptable to either a 2-inch-diameter, center-perforated or 6-inch-diameter, end burning primary combustor. A variable-length, 5-inch-diameter ramburner is used. The combustion processes occurring in the primary and secondary chambers are monitored by means of wall pressure

and temperature measurements, thrust measurement, residue sampling and optical techniques. Facility performance capabilities, system calibration and preliminary evaluation of baseline direct-connect testing are presented. Author (GRA)

N72-14288# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept. (SI).
CVA-67 SPRING CONSTANTS FOR THE SHOCK ANALYSIS OF CATAPULT INSTALLATIONS Final Report
Thomas A. Mazzella and Julian Holowchak 4 Jan. 1971 200 p refs
(Air Proj. 17-X-4912.1403)
(AD-729249; NAEC-ENG-7649; Code-80020; Job-84F02-21-58471) Avail: NTIS CSCL 13/9

The Spring Constants of the ship's portion of the foundation springs for the launching engine section of the catapult installations aboard the CVA-67 are determined or summarized.
Author (GRA)

N72-14289# Princeton Univ., N.J. Dept. of Civil and Geological Engineering.
A FIRST APPROXIMATION SATELLITE TERMINAL SYSTEM EVALUATION MODEL Final Report
Jack E. Snell Mar. 1971 173 p refs
(Contract DOT-FA70WA-2385)
(AD-724958; FAA-AV-71-1) Avail: NTIS CSCL 01/5

To evaluate a variety of off-airport Satellite Air Terminal concepts, an iterative evaluation model is developed that is focused primarily on time and cost impedances. An analysis is made of the entire process by which a passenger gains access to an aircraft and from this analysis, component sub-models are developed to define system demand flow rates, level of service supplied, and system costs. These sub-models are then synthesized into the desired evaluation model and a methodology to be used in establishing off-airport Satellite Terminal system planning guidelines is developed. The approach utilizes generalized or gross characteristics for the airport access process and avoids specific details of regional characteristics, airport design and transport technology. A hypothetical example is tested and sensitivity analyses are made for a number of cost and time parameters. Author (GRA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-14290 Polytechnic Inst. of Brooklyn, N.Y.
STUDIES IN HOMOGENEOUS AND NONHOMOGENEOUS FREE TURBULENT SHEAR FLOWS Ph.D. Thesis
Nicholas Peter Trentacoste 1970 149 p
Avail: Univ. Microfilms Order No. 70-26115

An evaluation of the state-of-the-art of turbulent mixing, by surveying the prevalent concepts and conclusions that have influenced research trends in this field is presented. A critical discussion of the currently favored instruments utilized for obtaining measurements of the time mean properties of a turbulent flow is rendered; in addition, experimental evidence is presented to question the validity of such measurement techniques. A succinct description of the methodology utilized in ascertaining the consistency of experimental measurements with the particular properties of a given flow field is also discussed. An extension of the original Reichardt inductive theory of free turbulence is presented. This theory is utilized to solve the problem of a turbulent axisymmetric jet exhausting into a quiescent ambient under arbitrary initial conditions. The theory may be easily generalized to treat the more fashionable two stream mixing problem. Results of the analysis are compared with the mean property measurements of this investigation, and excellent agreement is obtained. Dissert. Abstr.

N72-14291 Polytechnic Inst. of Brooklyn, N.Y.
HYPERSONIC VISCOUS INTERACTIONS Ph.D. Thesis
Tony C. Lin 1970 194 p
Avail: Univ. Microfilms Order No. 70-26081

Hypersonic external and internal flows with viscous interaction are considered. A general and practical method for studying the external flow around a slender, three dimensional body is developed. Of major interest is the detailed flow structure in the merged layer and the strong interaction regions near a leading edge. A single set of equations, which is uniformly valid throughout the disturbed flow, is derived. These equations, which are essentially parabolic in nature, are integrated numerically by implicit, as well as explicit, finite difference schemes. An implicit method is shown to be reasonably accurate, fast and stable, and appears able to handle general three dimensional diffusion-type equations. The existing numerical techniques for three dimensional heat conduction equations are briefly reviewed. The viscous hypersonic flow near the entrance region of a cylindrical tube is analyzed with the use of the Navier-Stokes equations. Emphasis is placed on the viscous-inviscid interactions, the effects of transverse curvature, and the distinction between internal and external flows. Dissert. Abstr.

N72-14292 Stevens Inst. of Tech., Hoboken, N.J.
THICKNESS EFFECTS IN NONSTATIONARY CASCADE FLOW Ph.D. Thesis
John William Nemesh 1970 181 p
Avail: Univ. Microfilms Order No. 71-1176

A method for calculating nonstationary lift and moment coefficients for an unstalled vibrating cascade of blades with finite thickness and camber is developed. A FORTRAN program is given for the calculation. Quasi-static experiments were performed to give a check for the steady thickness and camber part of the theory. The data are extrapolated back to vanishingly small torsional amplitudes. In addition, it is shown that, for a quasi-static type of motion, flutter is possible due to the existence of a phase angle between adjacent blades.
Dissert. Abstr.

N72-14293 New York Univ., N.Y.
AN EXPERIMENTAL STUDY OF THE FLOW ABOUT A SLENDER CONE AT HYPERSONIC SPEEDS Ph.D. Thesis
Irwin E. Vas 1970 516 p
Avail: Univ. Microfilms Order No. 71-81

An experimental investigation was performed to determine the flow field about sharp and slightly blunted conical bodies at hypersonic speeds over a range of Reynolds numbers in which the flow regimes extend from continuum to near-free molecular. Four different flow field measurements were made, and the flow field characteristics were determined using these measurements in four different calculation methods. It was found that the measuring techniques worked quite adequately without corrections in certain specified flow regimes. Comparisons were made between the flow field measurements and calculations which were available for the blunted cone with merged flow. The effect of the small bluntness was investigated experimentally. This bluntness had a significant effect at the high Reynolds number, but essentially no effect at the low Reynolds number.
Dissert. Abstr.

N72-14294 Tennessee Univ., Knoxville.
INVESTIGATION OF SUPERSONIC FLOW OVER A REARWARD FACING STEP Ph.D. Thesis
Michael Wen-Shean Su 1970 158 p
Avail: Univ. Microfilms Order No. 71-370

An investigation of the near wake flow field generated by a rearward facing step at supersonic speeds was conducted. Evaluations were made on measurements on the oncoming boundary layer, the free shear layer and the lip shock by pitot

and static pressure surveys. The measured free shear layer profiles were compared at different free stream Mach numbers, Reynolds numbers and step heights. Based on the heat transfer correlation formula, a direct and more simple hotwire data reduction technique was developed. The flow structure of the recirculating region was explored with hot-wire measurements. The extent of upstream influence was correlated. A new base pressure correlation parameter was developed for fully laminar or transitional flows. Dissert. Abstr.

N72-14295 California Univ., Berkeley.
SHOCK INTERSECTION PROCESSES Ph.D. Thesis
James John Smolen 1970 146 p
Avail: Univ. Microfilms Order No. 71-844

The analysis of wave systems resulting from an intersection process is presented, using the appropriate conditions of invariance associated with a collision as the basis for solution. To check the physical validity of the theory, experiments were performed in a shock tube of rectangular cross section using ramps to generate simple wave intersection processes. Records of these processes were obtained by means of a stroboscopic laser Schlieren system and the soot track technique. The investigations included the cases of a ramp-generated Mach intersection and the head-on collision, as well as the formation of a reactive Mach stem. Dissert. Abstr.

N72-14296 Ohio State Univ., Columbus.
THE SUPERSONIC AXISYMMETRIC WAKE ABOUT A TRAILING TOW CABLE Ph.D. Thesis
Charles Herbert Law 1970 173 p
Avail: Univ. Microfilms Order No. 70-26318

A detailed investigation of the flow properties in the axisymmetric near wake about a trailing tow cable behind a 10 degree half-angle cone faired at the apex into a circular supporting rod at Mach 3.65 was conducted. Experimental tests were carried out in a blow-down type wind tunnel using a model support rod cantilevered into the test section through the nozzle throat and with 1/16 inch and 1/4 inch rods extending from the model base (one inch in diameter) used to simulate the trailing two cables. The tests were conducted at free-stream Reynolds numbers of 7670, 49,400, and 455,000; laminar, transitional, and turbulent wakes were obtained at these respective Reynolds numbers. Data obtained include radial profiles of total temperature, total pressure, and static pressure to two base diameters downstream of the model base. Mach number and velocity profiles were calculated from this data in the region downstream of the wake rear stagnation point. Dissert. Abstr.

N72-14297 Rochester Univ., N.Y.
ON THE INSTABILITY OF HAGEN-PIOSEUILLE FLOW WITH RESPECT TO FINITE AMPLITUDE DISTURBANCE Ph.D. Thesis
Kah Hie Lau 1970 117 p
Avail: Univ. Microfilms Order No. 71-1403

The effects of finite amplitude disturbances on the instability of Hagen-Pioseuille flow were analyzed. Linear wall mode eigenfunctions were used to calculate the Reynolds stress, and the distorted velocity profile obtained was examined for the stability problem. It was found that for disturbance intensities of 0, 3.5%, 4% and 5%, the critical Reynolds numbers were infinity, 6000, 4200, and 2900 respectively. Dissert. Abstr.

N72-14298# Technische Hogeschool, Delft (Netherlands).
NON-ISOTHERMAL LAMINAR FLOW Ph.D. Thesis
Pieter Barteld Kwant 1971 246 p refs
Avail: NTIS

The aim of the present research was to procure reliable data on the hydrodynamics of and the heat transfer to nonisothermal, laminar flow of real fluids through ducts. The analysis and experiments are restricted to the geometries of the circular tube and the parallel plates and to the boundary condition of a constant wall temperature. It is shown how it is possible to incorporate a heat transfer resistance at the outside of the ducts in the results. Furthermore, it is assumed that all properties of the fluid other than the viscosity are temperature independent, and that at the entrance of the duct the flow is fully developed hydrodynamically with a uniform temperature. Author

N72-14299# Teledyne Brown Engineering, Huntsville, Ala.
VISCOUS INTERACTIONS OF SONIC TRANSVERSE JETS WITH SUPERSONIC EXTERNAL FLOWS
Carl T. K. Young and B. F. Barfield (Coll. of Petrol. and Minerals, Dhahran, Saudi Arabia) May 1971 29 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in May 1972
(JI-001) Avail: NTIS

A theoretical analysis for the determination of the separation distance of the upstream turbulent boundary layer and the amplification factor when a sonic jet issues laterally into a supersonic stream is presented. The free stream and the secondary jet are assumed to be of the same ideal gas, no mixing occurs in the immediate vicinity of the injection part, the surface is assumed to be adiabatic, and the flow is two dimensional. A single correlating parameter which includes the free-stream Mach number, jet pressure ratio, effective slot width, and the location of the slot has been proposed. Author

N72-14300# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE TRANSFER FUNCTION IN HYDROELASTIC INTERACTION PROBLEMS
V. D. Kubenko [1971] 4 p refs Transl. into ENGLISH from Prikl. Mekh.(USSR), v. 7, no. 10, 1971 p 131-134
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The diffraction problems of a nonstationary hydroacoustic wave by a stiff shell of revolution was examined. The potential of the reflected wave was determined in terms of the incident wave potential. Simple analytical expressions were obtained for the approximation of the transfer functions. These expressions are examined using radiated waves, and found to be reasonably accurate. E.H.W.

N72-14301*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS WHICH INFLUENCE THE ANALYSIS AND DESIGN OF EJECTOR NOZZLES
Bernhard H. Anderson 1972 10 p refs Presented at 10th Aerospace Sci. Meeting, San Diego, Calif., 17-19 Jan. 1972
(NASA-TM-X-67976; E-6698) Avail: NTIS CSCL 20D

A theoretical analysis of the viscous interaction between the primary and secondary streams of ejector nozzles was developed. The analysis accounts for real sonic line effects and the streamwise variation in stream mixing and boundary layer within the ejector. The aspects of the analysis are explained and illustrated by applying the theory to a variety of ejector configurations including cylindrical shroud, contoured flap and plug nozzles. Extensive comparisons are made between theory and data to show the importance of various analytical assumptions and such design variables as diameter ratio, spacing ratio, total temperature ratio, and primary nozzle geometry. Author

N72-14302*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PEAK AXIAL-VELOCITY DECAY WITH SINGLE- AND MULTI-ELEMENT NOZZLES
U. H. VonGlahn, D. E. Groesbeck, and R. G. Huff 1972 18 p refs Presented at 10th Aerospace Sci. Meeting, San Diego, Calif., 17-19 Jan. 1972
(NASA-TM-X-67979; E-6703) Avail: NTIS CSCL 20D

Jet peak-velocity decay data were obtained for a variety of circular and noncircular single-element and multi-element nozzles for application to externally-blown-flap (EBF) STOL aircraft. These data permit a rational approach, in terms of element type

and element spacing, to nozzles designed to promote mixing of the jet exhaust with the surrounding air. Rapid mixing and the resulting lower axial jet velocity decreases the noise caused by the interaction of jet impingement on the flap assembly of EBF STOL aircraft. Empirical relationships are presented that permit the prediction of peak axial-velocity decay curves for a wide spectrum of mixer-type nozzles. The data are useful also in the design of ejector-type noise suppressors and for the suppression of VTOL downwash velocities caused by vertically oriented exhaust nozzles. Author

N72-14303*# New York Univ., N.Y. Dept. of Mathematics.
DIFFRACTION OF A PLANE WAVE BY A THREE-DIMENSIONAL CORNER
Lu Ting and Fanny Kung May 1971 53 p refs
(Grant NGL-33-016-119)
(NASA-CR-126482; NYU-AA-70-28) Avail: NTIS CSCL 20D

By the superposition of the conical solution for the diffraction of a plane pulse by a three dimensional corner, the solution for a general incident plane wave is constructed. A numerical program is presented for the computation of the pressure distribution on the surface due to an incident plane wave of any wave form and at any incident angle. Numerical examples are presented to show the pressure signature at several points on the surface due to incident wave with a front shock wave, two shock waves in succession, or a compression wave with same peak pressure. The examples show that when the distance of a point on the surface from the edges or the vertex is comparable to the distance for the front pressure raise to reach the maximum, the peak pressure at that point can be much less than that given by a regular reflection, because the diffracted wave front arrives at that point prior to the arrival of the peak incident wave. Author

N72-14304*# Israel Program for Scientific Translations, Ltd., Jerusalem.
HYDRODYNAMICS OF FREE-BOUNDARY FLOWS
G. V. Logvinovich 1972 200 p refs Transl. into ENGLISH of the publ. "Gidrodinamika Techeniiso Svobodnymi Granitsami" Kiev, Naukova Dumka, 1969 Sponsored by NASA and NSF
(NASA-TT-F-658; TT-70-50187) Avail: NTIS CSCL 20D

The hydrodynamics of a body moving in a fluid at high velocities with the formation of free boundaries is studied. The general physical flow properties at the front of the body, flows with developed cavitation, planing and other situations where allowance must be made for free boundary effects and surface discontinuity are considered. The general equations of the dynamics of a thin body are solved by a formula for computing the force due to vibrations of rigid and flexible thin bodies. The results for a flexible body are used to explain the swimming mechanism of fish and sea mammals. F.O.S.

N72-14305*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTICAL INVESTIGATION OF AN OSCILLATING WEDGE IN A SUPERSONIC PERFECT GAS FLOW Ph.D Thesis - North Carolina State Univ., Raleigh
Robert Merrill Bennett 1971 137 p refs
(NASA-TM-X-67576) Avail: NTIS CSCL 20B

Several aspects of the oscillating wedge are investigated to evaluate both the resulting trends for the wedge and methods of analyzing unsteady flows. An existing hypersonic small disturbance theory for an oscillating thin wedge is extended and applied. A perturbation method involving linearization about the known flow is then derived and discussed. Subsequently, a finite difference technique for calculating the complete unsteady flow field of the wedge in motion is presented and discussed in conjunction with some calculated quasi-static nonlinear trends. Author

N72-14306# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Raumfahrt-Aerodynamik.
FORCE AND HEAT TRANSFER IN FREE MOLECULAR FLOW WITH DIFFERENT EXPANSION FLOW DISTRIBUTION FUNCTIONS
H. Legge Nov. 1970 52 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-65; AVA-FB-7042) Avail: NTIS; ZLDI Munich: 12, DM

Gas expanding through a circular orifice forms a free jet in continuum flow and the Knudsen effusion in free molecular flow. An ellipsoidal distribution function seems to be a good approximation to the actual distribution function for the transition region between continuum and free molecular flow. The centerline flow properties of a Knudsen effusion are evaluated and compared with the flow properties of a free jet. Forces and heat transfer on a surface element dF in free molecular flow are calculated and compared for a Maxwellian and an ellipsoidal distribution function and for the actual distribution function of a Knudsen effusion. Author (ESRO)

N72-14307# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
AN INTEGRAL METHOD FOR THE CALCULATION OF THE FLAT PLATE BOUNDARY LAYER WITH NONEQUILIBRIUM DISSOCIATION AND WITH ARBITRARY CATALYTIC ACTIVITY AT THE WALL Ph.D. Thesis - Tech. Univ. Berlin
M. Jischa 1971 65 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-24) Avail: NTIS; DFVLR, Porz: 18,20 DM

An integral method of the Pohlhausen-type is derived to calculate the nonequilibrium flat plate boundary layer for a binary mixture consisting of atoms A and molecules A2. The catalytic efficiency of the wall can be chosen arbitrarily. The method is based on the Crocco relationship between the enthalpy and velocity profile for Prandtl and Lewis number unity. The velocity profile is assumed to be known and a trial solution is made for the unknown atom mass fraction profile. Then the shape parameter and a characteristic boundary layer thickness are obtained from the integral relations for momentum and diffusion. Author (ESRO)

N72-14308# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
A COMPUTER PROGRAM FOR THE CALCULATION OF BOUNDARY LAYER DEVELOPMENT
P. Bradshaw Nov. 1971 18 p refs Addendum to NPL-71-24
(IC-AERO-71-24; NPL-71-24) Avail: NTIS

Extensions to the computer program used in two-dimensional turbulent boundary layer calculations based on a hyperbolic system and using a numerical method are described. The basic method and the extensions are given for compressible adiabatic flow, constant heat transfer, three-dimensional flow (for an infinite swept wing), and two-dimensional ducted flow. Further versions of the basic program are described. ESRO

N72-14309# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
INFLUENCE OF A LOCAL PRESSURE GRADIENT ON THE DEVELOPMENT OF INSTABLE FREQUENCIES IN THE LAMINAR BOUNDARY LAYER [INFLUENCE D'UN GRADIENT LOCAL DE PRESSION SUR LE DEVELOPPEMENT DES FREQUENCES INSTABLES DANS LA COUCHE LIMITE LAMINAIRE]
S. Burnel (Orleans Univ.) and P. Gougat Oct. 1971 48 p refs In FRENCH; ENGLISH summary
(Rept-71-5) Avail: NTIS

The influence of a local disturbance on the position of the transition on a flat plate in an incompressible flow is demonstrated. Two different phenomena are investigated: (1) the disturbance of the boundary layer by a vortex street downstream of a cylinder, and (2) a wall disturbance located in the laminar region. The measurement of the frequency amplification in the instable region shows that the beginning of the transition is directly related to the local pressure gradient. Author (ESRO)

N72-14310# Ballistic Research Labs., Aberdeen Proving Ground, Md. Exterior Ballistics Lab.

AN EXPERIMENTAL INVESTIGATION OF THE SUPERSONIC TURBULENT BOUNDARY LAYER IN A MODERATE ADVERSE PRESSURE GRADIENT. PART 2: ANALYSIS OF THE EXPERIMENTAL DATA

W. B. Sturek Jun. 1971 61 p refs

(RDT/E Proj. 1T0-61102-A-33-D)

(AD-729325; BRL-1543-Pt-2) Avail: NTIS CSCL 20/4

Turbulent boundary layer equations applicable to compressible flow over a surface with longitudinal curvature are evaluated by numerical integration using the tabulated profile data. Curvature corrections to the equation for conservation of streamwise momentum are shown to be small but of the same order of magnitude as the wall shear stress. The data are shown to correlate in law of the wall and velocity defect dimensionless coordinates using an integral compressibility transformation. Values of skin friction coefficient calculated using the experimental data are compared to other experimental data and to values predicted using the Spalding-Chi method.

Author (GRA)

N72-14311# Naval Ship Research and Development Center, Washington, D.C.

LIMITING CONDITIONS TO SIMILARITY-LAW CORRELATIONS FOR DRAG-REDUCING POLYMER SOLUTIONS

Paul S. Granville Aug. 1971 26 p refs

(AD-729262; NSRDC-3635) Avail: NTIS CSCL 20/4

Similarity-law correlations for drag-reducing polymer solutions are shown to require sufficiently thick turbulent shear layers. Limiting conditions occurring for the shear layers thinned down to only a laminar sublayer and an interactive (buffer) sublayer are examined on the basis of an interactive logarithmic law. Subcritical and supercritical regimes are defined on the basis of shear layer thickness. Author (GRA)

N72-14312# Naval Ordnance Lab., White Oak, Md.

STABILITY OF A VISCOUS JET NON-NEWTONIAN LIQUIDS

Ralph E. Phinney and Waymon Humpries 7 May 1971 54 p refs

(AD-729236; NOLTR-71-123) Avail: NTIS CSCL 20/4

An experimental investigation is made of the stability of viscous jets of a non-Newtonian fluid consisting of solutions of CMC (Carboxymethyl Cellulose) in water. The Newtonian fluid properties of CMC solutions are correlated in terms of a relaxation time, which can be estimated theoretically, and two characteristic viscosities, all of which depend only on the additive concentration. The breakup distance for CMC solutions is compared to the known properties of Newtonian jets, as well as theoretical and experimental results for non-Newtonian fluids from other sources. Author (GRA)

N72-14313# Ohio State Univ. Research Foundation, Columbus.

A SUMMARY OF THE FACTORS INFLUENCING THE EXTENT OF SEPARATION OF A LAMINAR BOUNDARY LAYER DUE TO A COMPRESSION CORNER AT MODERATELY HYPERSONIC SPEEDS Final Report, 18 May 1970 - 30 Apr. 1971

Karlheinz O. W. Ball Wright-Patterson AFB, Ohio ARL Apr. 1971 46 p refs

(AF Proj. 7064-00-06)

(AD-729446; ARL-71-0065; DoD-Element-61102F; DoD-Subelement-681307) Avail: NTIS CSCL 20/4

A summary is presented of the effects of flow and geometric factors on the extent of separation of a laminar boundary layer. Consideration is given to the Mach number, Reynolds number, wall to free stream temperature ratio, hinge line mass transfer, span and chord dimensions of the model and compression surface, and the angle of deflection of the compression surface. The results are presented as analytical and correlated expressions to determine the basic parameters of the separation phenomenon for engineering design estimates.

Author (GRA)

N72-14314# Minnesota Univ., Minneapolis. School of Mathematics

ASYMPTOTIC BEHAVIOUR OF SOLUTIONS OF THE POROUS MEDIA EQUATION

L. A. Peletier Apr. 1971 22 p refs

(Contract N00014-67-A-0113-0022; NR Proj. 041-406)

(AD-729672; TR-2) Avail: NTIS CSCL 20/4

A degenerate quasi-linear parabolic equation, which arises in the study of fluid flow through porous media is investigated. It is shown that the solutions of a class of mixed initial-boundary value problems in the domain $x = 0$, $t = 0$ converge upon a suitably chosen similarity solution as t approaches infinity. The rate of convergence is discussed. Author (GRA)

N72-14315# Minnesota Univ., Minneapolis. School of Mathematics.

SIMILARITY PROFILES OF FLOW THROUGH POROUS MEDIA

F. V. Atkinson and L. A. Peletier Mar. 1971 19 p refs

(Contract N00014-67-A-0113-0022; NR Proj. 041-406)

(AD-729671; TR-1) Avail: NTIS CSCL 20/4

The authors investigate the existence and uniqueness of a class of similarity solutions of an equation which arises in the study of fluid flow through porous media. GRA

N72-14316# Minnesota Univ., Minneapolis. School of Mathematics.

ON THE ASYMPTOTIC BEHAVIOR OF VELOCITY PROFILES IN LAMINAR BOUNDARY LAYERS

L. A. Peletier Apr. 1971 18 p refs

(Contract N00014-67-A-0113-0022)

(AD-729673; TR-3) Avail: NTIS CSCL 20/4

The author discusses the downstream development of the velocity profile in the steady two-dimensional laminar flow of an incompressible fluid past a rigid wall. It was shown by Serrin (1967) that when the streaming speed is of the form U (x) = C (x + d)sup m) (m = or > 0), a velocity profile, chosen quite arbitrary at some point along the wall, converges downstream upon the familiar Falkner-Skan similarity profile. The author obtains, by rigorous, though elementary means, an estimate for the rate of convergence. Author (GRA)

N72-14317# Naval Research Lab., Washington, D.C.

THE DRAG REDUCTION OF DILUTE POLYMER SOLUTIONS AS A FUNCTION OF SOLVENT POWER, VISCOSITY, AND TEMPERATURE Interim Report

Paul Peyser and Ralph G. Little 29 Jul. 1971 21 p refs

(RR Proj. 001-43-4766; NRL Proj. C02-20)

(AD-729644; NRL-7305) Avail: NTIS CSCL 20/4

The frictional drag reduction of high-molecular-weight polyethylene oxide and polystyrene solutions under turbulent flow conditions was studied as a function of temperature, solvent power, and solvent viscosity. A rotating disk apparatus was used to make the drag reduction measurements. For aqueous polyethylene oxide solutions, at concentrations well above that needed to produce maximum drag reduction, all drag reduction data reduced to a common curve when percent drag reduction was plotted against the Reynolds number for the flow. However, for polyethylene oxide solutions below this optimum concentration the drag reduction-versus-Reynolds number curves showed decreasing drag reduction with increasing temperature. The data are explained primarily in terms of the inverse temperature solubility characteristics of polyethylene oxide in water. The percent drag reduction of polystyrene in nonaqueous liquids was found to be greater in good solvents than in poor ones. It was also found that increases in solvent viscosity and decreases in temperature increased the percent drag reduction. The results are discussed in relation to the current drag reduction theories and are shown to be in opposition to Virk's theory. It is concluded from the data that drag reduction is very likely a function of a relaxation time phenomenon involving the polymer molecules and the flow system. The results also emphasize the importance of considering solvent power, viscosity, and

temperature in the design of an efficient drag reduction system.
Author (GRA)

N72-14318# RAND Corp., Santa Monica, Calif.
THE EFFECT OF MASS TRANSFER ON HEAT TRANSFER IN HIGHER ORDER BOUNDARY LAYERS
K. Gersten and J. F. Gross Apr. 1971 39 p refs
(Contract F44620-67-C-0045)
(AD-729759; R-682-PR) Avail: NTIS CSCL 20/4

A determination is reported of the second approximation to the solution of the Navier-Stokes equations for incompressible, 3-dimensional flow near the stagnation line on a swept cylinder. Using the method of matched asymptotic expansions to determine the coefficients in expansions for the flow-velocity components, pressure, temperature, crossflow at the wall, and wall concentration, the authors studied the effect of wall mass transfer on the second-approximation coefficients for longitudinal curvature and displacement. The results indicate that longitudinal curvature and displacement effects are negative and lead to decreasing values of boundary-layer characteristics. GRA

N72-14319# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
FLOW FIELD DIAGNOSTICS IN RAREFIED SLIGHTLY IONIZED HYPERSONIC FLOW
Joel M. Avidor and Samuel Lederman Jun. 1971 127 p refs
(Contracts Nonr-839(38); DAHC04-69-C-0077; ARPA Order 529; ARPA Order 1442)
(AD-729798; PIBAL-71-18) Avail: NTIS CSCL 20/4

An experimental investigation was carried out in the hypersonic shock tunnel in which two diagnostic techniques, the cylindrical electrostatic probe and the electron beam density probe, were applied to flow field surveys in rarefied slightly ionized hypersonic flow. Their relative merits have been evaluated. It was found that both can be applied for flow field investigations and particularly, density tracing and mapping, provided that diffusion effects are nonexistent or negligible. In the course of this work, ion and neutral density profiles normal to a sharp flat plate and in the near wake of a 10 deg half angle cone were obtained. Also using flush electrostatic probes, the ambipolar diffusion flux of the ionized particles to the plate was measured. A comparison with theoretical results obtained using the Rudman-Rubin formulation for the hypersonic flow about a sharp flat plate modified for slightly ionized flow was carried out.
Author (GRA)

N72-14320# Naval Ship Research and Development Center, Washington, D.C.
DRAG REDUCTION AND DEGRADATION OF DILUTE POLYMER SOLUTIONS IN TURBULENT PIPE FLOWS
T. T. Huang and N. Santelli Aug. 1971 44 p refs
(AD-730052; NSRDC-3677; Task-SF-354-21-003; Task-01710)
Avail: NTIS CSCL 20/4

Drag reduction caused by dilute polyethylene oxide (POLYOX WSR-301) and anionic charged polyacrylimide (MAGNIFLOC 835 A) polymer solutions was studied experimentally in 1.918- and 0.455-cm smooth pipes. The POLYOX solutions tested are superior in drag reduction but inferior in shear-degradation resistance compared to the MAGNIFLOC solutions at corresponding concentrations. A three-layer mean velocity profile model appears to be more consistent with current and other data than a traditional two-layer model. The onset of measured drag reduction depends upon solution concentration and is seriously affected by shear degradation. Author (GRA)

N72-14321# Pratt and Whitney Aircraft, East Hartford, Conn.
OPTICAL TECHNIQUES FOR FLOW VISUALIZATION AND FLOW FIELD MEASUREMENTS IN AIRCRAFT TURBOMACHINERY Final Report on item 2, 14 Dec. 1970 - 14 Jul. 1971
Walter G. Alwang, Lawrence A. Cavanaugh, Ronald J. Burr, and Allan Hauer Aug. 1971 91 p refs
(Contract N00019-69-C-0322; Proj. R010-04-02)
(AD-730063; PWA-4276) Avail: NTIS CSCL 20/4

In the program two new optical methods of flow measurement were evaluated for eventual use in aircraft turbine engines. The methods studied were: holographic interferometry for visualization of flow and laser Doppler velocimetry (LDV) for pointwise measurement of velocity. Prototype instruments of each type were built and tested in measurements on a supersonic cascade. It was found that double-pulse diffuse-background holographic interferometry can disclose the position of moving density gradients such as blade shocks. The LDV system, a dual beam, dual scatter system capable of both forward and back scatter operation, was found to be effective in measuring mean velocity and turbulence intensity. Capabilities and limitations of both instruments were assessed and requirements for internal measurements in turbomachinery determined. In general, it was concluded that the equipment developed is ready for application in turbine engines.
Author (GRA)

N72-14322# Panametrics, Inc., Waltham, Mass.
RESEARCH STUDY AND EXPERIMENTAL PROGRAM TO DETERMINE THE PROPERTIES OF HIGH TEMPERATURE AND HIGH DENSITY GASES Interim Report, Sep. 1968 - Sep. 1970
C. Carey, J. Bradshaw, and E. H. Carnevale Arnold Air Force Station, Tenn. AEDC Sep. 1971 85 p refs
(Contract F40600-69-C-0004; AF Proj. 8951)
(AD-729784; AEDC-TR-71-191; Task-895102) Avail: NTIS CSCL 20/4

Transport property measurements with ultrasonic techniques are discussed over the entire temperature (100-15,000 degrees) and pressure (1-1000 atm) ranges. A chart of various techniques for the determination of transport properties in the various temperature and pressure ranges is given. Sound absorption and sound speed determinations were used to obtain thermophysical properties of argon, helium, nitrogen and air at room temperature and pressures between 1-500 atm. Several variations of pulsed ultrasonic techniques were used to obtain maximum precision in the gas property measurements. Sound speeds accurate to approximately 0.1% were obtained in all the gases. Thermal conductivity and specific heat ratios were deduced for air. A cavity technique was developed for high accuracy (-0.1 %) viscosity, thermal conductivity and bulk viscosity determinations. Initial tests were run to proof the technique at room temperature and pressure. Sound speed, Prandtl number and viscosity measurements were made which agree with accepted values to within 1%. Author (GRA)

N72-14323# Naval Ordnance Lab., White Oak, Md.
THE SONIC THROAT METHOD AND REAL GAS ONE DIMENSIONAL FLOW: AN APPLICATION TO AIR AND NITROGEN
Richard L. Humphrey and Jerry L. Wagner 18 Jun. 1971 33 p refs
(ORD Proj. 0832-128/092/U1754)
(AD-730029; NOLTR-71-91) Avail: NTIS CSCL 14/2

The one-dimensional flow equation for mass flow through the throat of a supersonic nozzle has been modified for use with real gas values of gamma and compressibility. Curve fits for gamma and Z and a simple iteration scheme have been developed for use with air and nitrogen over a temperature range of 300 to 6000 deg. K and a pressure of 10 to 100 atm. With this approach the sonic throat method can be used with the most recent gas tables to determine high temperature wind tunnel supply temperatures or enthalpies. Author (GRA)

N72-14324# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
AN EXPERIMENTAL STUDY OF HIGHLY COOLED BOUNDARY LAYER TRANSITION AND HEAT TRANSFER IN A SUPERSONIC FLOW Final Report, Oct. 1969 - Nov. 1970

Hudson L. Conley, Jr. and Robert M. Nerem Apr. 1971 57 p refs
(Contract F33615-69-C-1795; AF Proj. 1426)
(AD-729871; AFFDL-TR-71-21) Avail: NTIS CSCL 20/4

An experimental investigation of the effect of extreme wall cooling on boundary layer transition has been carried out on a 5.4 deg half-angle cone. The range of test conditions included unit Reynolds numbers from 1,000,000 to 3,500,000, local Mach numbers from 2.4 to 2.8, and wall-to-adiabatic wall enthalpy ratios from 0.018 to 0.045. Local transition Reynolds numbers were obtained from measurements of heat transfer distribution on the surface of the cone model and ranged from 550,000 to 1,800,000, based on distance from the tip of the cone, over the range of conditions covered. The results indicate a decreasing transition Reynolds number with increasing wall cooling. A unit Reynolds number effect on transition was observed. Author (GRA)

N72-14325# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
A PRELIMINARY HOT-WIRE INVESTIGATION OF CONE-WAKE TRANSITION AT M EQUALS 16 Final Report, 15 Jul. 1970 - 15 Jun. 1971
Seymour M. Bogdonoff and Francis R. Hama Jun. 1971 22 p refs
(Contract F04701-70-C-0302)
(AD-729881; SAMSO-TR-71-167) Avail: NTIS CSCL 20/4

Hot-wire surveys were conducted across the wake behind a magnetically-suspended, 10 deg. half-angle cone of 1 in. base diameter in the Mach 16 helium wind tunnel, both at the unit Reynolds numbers 120,000 and 270,000. At the higher Reynolds number, transition was observed at approximately 8 diameters downstream. The turbulent fluctuations were limited in the region near the outer edge of the wake, spreading out at an extremely slow rate. Author (GRA)

N72-14326# Naval Postgraduate School, Monterey, Calif.
JET DEFLECTION, NOISE AND PRESSURE DISTRIBUTION IN PROPORTIONAL AMPLIFIERS Ph.D. Thesis
Ercan Turken Sep. 1971 133 p refs
(AD-728698) Avail: NTIS CSCL 13/7

The study presents the experimental work done on the determination of angle, noise, and pressure distribution for proportional amplifiers. The deflection angles were measured by means of a small, lightstring attached to a needle. The turbulence components in the three directions were obtained through the use of the hot-wire anemometer. The "momentum balance" principal was employed to predict the deflection angles, by taking into account the effects of the momentum, static pressure, and centrifugal forces. The results so obtained were found to be in agreement with those obtained experimentally. The static wall pressures were obtained with a pressure transducer. The "two dimensional-inviscid" flow model was used throughout the work. Author (GRA)

N72-14327# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
ANALYSIS OF TURBULENT PIPE FLOW
Gdalia Kleinstein Jun. 1970 39 p refs
(Grant AF-AFOSR-1062-67; AF Proj. 9781-01)
(AD-730388; NYU-AA-70-12; Rept-61102F; Rept-681307) Avail: NTIS CSCL 20/4

Turbulent pipe flow is considered from a phenomenological point of view dividing the flow into three regions: the wall region, the core region, and the overlap region. Utilizing an extension of Millikan's analysis, a unified eddy viscosity is developed which holds everywhere in the pipe. The model leads to good prediction of mean velocity, turbulent shear, turbulent energy production rate, and direct viscous dissipation profiles as measured by Laufer, and good representation of the friction law for a wide range of Reynolds numbers. GRA

N72-14328# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
THEORY OF OPTIMUM SHAPES IN FREE-SURFACE FLOWS Final Technical Report
T. Yao-tsu Wu and Arthur K. Whitney Jun. 1971 92 p refs
(Contract Nonr-220(51))
(AD-730841; E-132F.1) Avail: NTIS CSCL 20/4

The report consists of three parts. Part I investigates the mathematical theory of variational calculus for the general problem of optimum hydromechanical shapes in a wide class of free surface flows. In Part II the general theory is applied to determine the optimum shape of a two-dimensional planing surface that produces the maximum lift. In Part III the optimum shape of a symmetric two-dimensional strut is determined so that the drag of this strut in infinite cavity flow is a minimum. Author (GRA)

N72-14329# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
NUMERICAL AND WIND TUNNEL SIMULATION OF RESPONSE OF STRATIFIED SHEAR LAYERS TO NONHOMOGENEOUS SURFACE FEATURES
Tetsuji Yamada and Robert N. Meroney Jun. 1971 315 p refs
(Contract N00014-68-A-0493-0001; NR Proj. 062-414/6-6-68)
(AD-730953; CER70-71TY-RNM62) Avail: NTIS HC $6.00/MF $0.95 CSCL 04/1

In the report, four different categories of flow are investigated in a thermal wind tunnel. They are: Airflow over an infinitely wide obstacle; Airflow over an infinitely wide heated island; Airflow over an infinitely wide heated obstacle; and, Airflow over a heated island with a finite width. The first three categories are two dimensional aspects of prototype phenomena: a mountain lee-wave, an urban heat island, and a heated mountain, respectively. The last displays a three dimensional feature of a corresponding urban heat island phenomenon. Numerical models were constructed for the first three cases. However, for the three dimensional problem, only the wind tunnel experiment was conducted since a numerical integration for such a three dimensional problem is not practical yet. Both laboratory and numerical results showed close agreement. They indicated strong nonlinearity; perturbation quantities could not be neglected compared with their mean values especially in the vicinity of the disturbing source (obstacle, heated area), and a linear super-position rule could not be applied to predict the solution of combined effects of heating and topography. Author (GRA)

N72-14330# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
COAXIAL IMPINGEMENT OF AXISYMMETRIC JETS
Donald O. Rockwell and Edmund M. Herrold (National Science Foundation) Jun. 1971 27 p refs
(Contract N00014-69-A-0417)
(AD-730718; TR-6) Avail: NTIS CSCL 13/7

A system of axially impinging axisymmetric jets was examined experimentally using water as the working fluid. A wide range of jet Reynolds number was considered for several jet nozzle exit spacings. The location of the radial jet (impact surface) for a given ratio of flows from the two nozzles was found to be a strong function of the jet Reynolds number. The flow instabilities which can occur in this system of impacting jets have been grouped into two classes, axial mode and radial mode. These instabilities can offer an explanation of time dependence of the flow measured by other investigators. Author (GRA)

N72-14331# Defense Documentation Center, Alexandria, Va.
INCOMPRESSIBLE FLOW, VOLUME 1 Report Bibliography, Nov. 1961 - Feb. 1971
Sep. 1971 275 p refs
(AD-730300; DDC-TAS-71-37-1-Vol-1) Avail: NTIS CSCL 20/4

The bibliography consists of references to unclassified and unlimited reports which were processed into the AD data bank

from January 1962 through March 1971. These citations include mathematical models and theoretical discussions in addition to data on actual and experimental conditions as applied to incompressible flow. GRA

N72-14332# Virginia Polytechnic Inst., Blacksburg. Dept. of Aerospace Engineering.
TURBULENT FLOW OF NON-NEWTONIAN FLUIDS
E. R. VanDriest May 1971 33 p refs
(Grant AF-AFOSR-2039-71; AF Proj. 9781-02)
(AD-729938; AFOSR-71-2285TR; Rept-61102F; Rept-681307) Avail: NTIS CSCL 20/4

The phenomenon of drag reduction in turbulent flow of solutions of fluids with long-chain molecules (polymers) is studied from the point of view that the effect is due solely to the non-Newtonian variation of fluid shearing stress with strain, that is, variation of viscosity with strain. That the viscosity of the solvent is the essential physical property that controls the phenomenon is obtained from the direct effect of temperature. It is also shown that the commencement of turbulent friction reduction is essentially independent of the length of class of polymer, as well as concentration. Author (GRA)

N72-14333# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
HIGH FREQUENCY JET EXCITATION
Donald O. Rockwell Jun. 1971 43 p refs
(Contract N00014-69-A-0417)
(AD-730717; ONR-Code-461; TR-5) Avail: NTIS CSCL 20/4

A planar jet was subjected to transverse periodic disturbances of relatively high dimensionless frequency such that the vortex growth of the jet could be controlled for transitional and turbulent jet Reynolds numbers. Changes in the apparent time mean characteristics of the jet in its initial formation region, due to the applied distrubances, are related to the behavior of vortices. The processes of vortex formation, growth, and coalescence in the initial formation region are portrayed. Consideration is given to the alteration of these processes as a function of the dimensionless applied disturbance. Author (GRA)

N72-14334# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
NATURAL BREAKDOWN OF PLANAR JETS
Donald O. Rockwell and Wesley O. Niccolls Jun. 1971 43 p refs Prepared in cooperation with Harry Diamond Labs., Washington, D.C.
(Contract N00014-69-A-0417)
(AD-730716; ONR-Code-461; TR-4) Avail: NTIS CSCL 20/4

The growth of planar jets is studied using the hydrogen bubble technique of flow visualization. Flows which are initially laminar and initially turbulent at the nozzle exit are considered. Generation of streaklines and timelines permit characterization of the process of vortex formation and coalescence. Both symmetrical and asymmetrical modes of vortex growth and coalescence, along with the resultant deformation of the jet core flow, are examined. Nascent and mature stage coalescence are defined and portrayed. Vortex axial transport velocity and frequency of formation of the vortices are evaluated for selected Reynolds numbers. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-14335 National Lending Library for Science and Technology, Boston Spa (England).
COSMIC VIEW OF THE OCEAN
2 Jul. 1971 5 p Transl. into ENGLISH from Gudok (USSR), 1971
(NLL-M-20751-(5828.4F); NLL-II7H8075/B) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The use of orbiting satellites in the analysis of oceanographic problems and factors is discussed. Economic aspects of ocean studies are noted. K.P.D.

N72-14336 Department of Energy, Mines and Resources, Ottawa (Ontario).
RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA. REPORT NO. 5: FORESTRY AND WILDLANDS
Dennis White, ed. 1971 23 p
(M75-2/5) Copyright. Avail: Issuing Activity

The disciplines of forestry, ecology, wildlife science and related aspects of soil and land studies are discussed. The benefits derived through application of remote-sensing techniques in these fields are investigated. Users in these disciplines are relatively well informed about traditional air photography and its application to forestry and wildland programs. Large, operational, air-photographic projects have been undertaken by Federal, provincial and industrial agencies. Remote-sensing research is active and tends to be concentrated in Federal agencies, some universities and the larger, provincial, forest-inventory organizations. Nevertheless much further research is required to test new techniques in remote sensing and data interpretation, and to evaluate the potential of sensors in the non-visible ranges of the spectrum. Author

N72-14337 Department of Energy, Mines and Resources, Ottawa (Ontario).
RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA. REPORT NO. 6: GEOLOGY
Dennis White, ed. 1971 43 p ref
(M75-2/6) Copyright. Avail: Issuing Activity

The use of remote sensors in Earth Resources Technology Satellites and other unmanned satellites to observe and report on Canadian geological formations is discussed. The potential of remote sensing from both high and low altitudes is investigated and geological applications that could be improved, augmented, or replaced by remote sensing technology are described. A program to develop the equipment and techniques for conducting aerial reconnaissance of earth resources is recommended. Author

N72-14338 Department of Energy, Mines and Resources, Ottawa (Ontario).
RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA. REPORT NO. 8: WATER RESOURCES
1971 32 p
(M75-2/8) Copyright. Avail: NTIS

The use of remote sensors mounted in Earth Resources Technology Satellites and other manned-unmanned satellites to determine water resources in Canada is discussed. Items of consideration are: (1) how to handle and interpret the data obtained from satellite observations, (2) determination of the pertinent remote sensing observables and their relative importance and value, and (3) to identify research programs which could benefit from such a program. The organization and funding involved in the project are described. Author

N72-14339 Department of Energy, Mines and Resources, Ottawa (Ontario).
RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA REPORT NO. 9: SATELLITE AND GROUND STATION ENGINEERING
1971 43 p
(M75-2/9) Copyright. Avail: NTIS

A number of potential Canadian sites for an Earth Resources Technology Satellite (ERTS) ground station are evaluated, and

the costs of developing a ground station at the different locations are estimated. Although a station at Churchill would provide the best coverage of Canadian terrain, it is recommended that the station be located at Prince Albert, Saskatchewan: largely because of the short time available for the design and construction. The gain of the 84-foot dish antenna at Prince Albert has been measured, and found adequate for the ERTS mission so that only the feed and tracking system need be replaced. The amount of data that can be acquired by the station is estimated to vary between 25 and 40 minutes per day depending on the season. Author

N72-14340 Texas Univ., Austin.
AN INVESTIGATION OF THE MAGNETOTELLURIC TENSOR IMPEDANCE METHOD Ph.D. Thesis
Darrell Roy Word 1970 279 p
Avail: Univ. Microfilms Order No. 71-216

Magnetotelluric soundings were made at 7 sites along a sixty mile traverse east of Austin, Texas in the frequency band .0001 to 10 cps. The traverse bears NW-SE and crosses the Ouachita fold belt system on the flanks of the Llano Uplift. The sounding covers the depth range of 0.1 to 100 Km. The earth model derived from the sounding includes a vertical cross section of the estimated conductivity distribution and estimates of the strike directions of the various formations represented by the cross section. The model is compared with available geological information and an attempt is made to explain some of the observed three-dimensional properties of the impedance function. An error analysis is offered for the interpretation considering the possible consequences of three-dimensional geometry when a two-dimensional interpretation is used. The model is in good agreement with expected geology to depths for which surface and bore hole data can be reasonably extrapolated. Dissert. Abstr.

N72-14341 California Univ., Los Angeles.
GEOMAGNETIC CROCHETS AND IONOSPHERIC TIDAL WINDS Ph.D. Thesis
Arthur Dean Richmond 1970 174 p
Avail: Univ. Microfilms Order No. 71-686

The present investigation is divided into two parts. The first part establishes the usefulness of the geomagnetic crochet (solar flare effect) as a tool for studying solar flare radiation and its ionospheric effects. The second part is devoted to a study of the influence of various dissipative mechanisms on the propagation of atmospheric tides in the lower ionosphere. It is found on both theoretical and observational grounds that crochets closely follow flare-time variations in ionospheric electron densities, to time scales of several seconds or less, implying that ionospheric self-inductance is relatively uninfluential. The theoretical treatment of tides in a spherical, rotating atmosphere considers the influence of perturbation-size Lorentz and viscous forces and heat conduction effects on the tides in source-free atmospheric regions. These dissipative mechanisms cause the amplitude of the tidal disturbance to cease growing with height at some altitude dependent on the frequency and vertical wavelength of the oscillation. Dissert. Abstr.

N72-14342 California Univ., Los Angeles.
TIDAL WINDS IN THE MESOSPHERE AND IONOSPHERE Ph.D. Thesis
Edmund Stanley Batten 1970 153 p
Avail: Univ. Microfilms Order No. 71-581

The effects of heat conductivity and the absorption of solar radiation in the thermosphere are added to the existing tidal theory. The results are then compared with observations to determine the extent to which these factors can explain the features of the winds observed in the lower thermosphere. The results indicate that many of the features of the ionospheric wind profiles can be explained in terms of a tidal theory including the effects of dissipation and thermospheric heating. However, additional dissipation and, for some tidal modes, additional excitation is indicated. Further, the importance of tidal excitation by water vapor is emphasized by showing that the oscillations of the (1,1) mode excited by water vapor are critically matched to those excited by ozone. Therefore, it is suggested that variations in water vapor excitation may be a source of the day-to-day changes observed in the solar daily variation current systems. Dissert. Abstr.

N72-14343 Texas Univ., Austin.
DETECTION AND ANALYSIS OF CLEAR AIR TURBULENCE USING RADAR AND OTHER SENSORS Ph.D. Thesis
Allan Barr Plunkett 1970 115 p
Avail: Univ. Microfilms Order No. 71-174

It is generally known that a region of clear air turbulence will many times have associated with it a sufficient amplitude of disturbed refractive index to allow detection by radar. The study objectives were to determine: (1) The characteristics of the radar return associated with a region of disturbed refractive index, and (2) The relationship between the magnitudes of the mechanical turbulence and the disturbed refractive index. These objectives were accomplished by using airplane carried refractometers, temperature sensors, and accelerometers to examine locally the regions in question at the same time as the radar was operating. The results show that a knowledge of the wind shear plus the buoyancy force is sufficient to determine the existence of a region of mechanical turbulence. The magnitude of the mechanical turbulence can be determined fairly well from the magnitude of the disturbed refractive index if the gradient of the average refractive index with the height is known and is sufficiently large. Dissert. Abstr.

N72-14344# Joint Publications Research Service, Washington, D.C.
INVESTIGATIONS OF THE ATMOSPHERE AND IONOSPHERE DURING PERIOD OF INCREASED SOLAR ACTIVITY
V. V. Mikhnevick, ed. and A. D. Danilova, ed. 16 Dec. 1971 189 p refs Transl. into ENGLISH from the Publ. "Issledovaniya Atmosfery i Ionosfery v Period Povyshennoy Solnechnoy Aktivnosti" Leningrad, Hydrometeorol. Publishing House, 1970 p 5-153
(JPRS-54718; UDC-551.510.535+523.745) Avail: NTIS

Ionospheric and atmospheric measurements taken by rocket, radiosonde and ground-based methods during a period of heightened solar activity are reported. A relationship is established between solar activity, corpuscular fluxes, ionization in the ionosphere, and upper atmospheric circulation and composition. For individual titles, see N72-14345 through N72-14362.

N72-14345# Joint Publications Research Service, Washington, D.C.
OCCURRENCES IN ATMOSPHERE DURING PERIOD OF MAGNETIC STORMS
V. V. Mikhnevich *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 1-15 refs (See N72-14344 05-13)
(UDC-551.510:550.385.4) Avail: NTIS

Results obtained from studying the thermobaric parameters of the atmosphere, ionosphere and circulation during the period of magnetic storms are reviewed. During such storms, variations occur in pressure in the troposphere, stratosphere and thermosphere; concentrations in electrons and height of maximums for D, E and F regions also vary; there is a modification in the circulatory regime in the troposphere. Attention is drawn to the fact that in the troposphere and stratosphere, variations in pressure do not occur synchronously with temperature variations. Author

N72-14346# Joint Publications Research Service, Washington, D.C.
PROBLEMS AND ORGANIZATION OF SUN-ATMOSPHERE EXPERIMENT c31
V. P. Teslenko and A. A. Fokin *In its* Invest. of the Atmosphere

and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 16-26 refs (See N72-14344 05-13)
(UDC-551.510.535:551.508) Avail: NTIS

The general problems and program of conducting the sun-atmosphere experiment are discussed. Information is presented concerning the composition of the meteorological rocket complex MR-12 and the purpose of its basic systems. The principles of constructing a functional system and a design aggregation of the nose cone on the MR-12 rocket are considered; also analyzed are technical-operational requirements imposed on the onboard rocket equipment and ways for meeting these requirements in the development of the nose sections of meteorological rockets. Author

N72-14347# Joint Publications Research Service, Washington, D.C.
MEASUREMENTS OF A FLUX OF CORPUSCLES WITH FOSFOR TYPE INSTRUMENTS **c29**
T. V. Kazachevskaya and A. I. Koryagin *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 27-37 refs (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

Results were obtained from measuring the flow of soft electrons at heights of 100-800 km during the period from 18 to 23 April 1969 at solar zenith = 86 deg. As a radiation receiver, use was made of thermophosphorus CaSO4-Mn. The complete energy flux of electrons at heights h > 140 km changed from 0.2 erg/sq cm sec.steradian on 18 April to 0.02-0.03 erg/sq cm sec.steradian on 21 April. A determination was made of the electrons' parameters of energy spectrum. The derived values of electron fluxes and their variation from day to day should influence the ionozation of the lower part of the E region at heights of about 100 km. Author

N72-14348# Joint Publications Research Service, Washington, D.C.
MEASURING THE ENERGY SPECTRUM OF ELECTRONS FLUX IN UPPER ATMOSPHERE **c29**
L. A. Antonova, G. S. Ivanov-Kholodnyy, and V. S. Medvedev *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1972 p 38-42 ref (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

Measurements have been taken of the energy spectra of electrons in the upper atmosphere of middle altitudes at heights of around 100-170 km. The secondary-electron multiplier constitutes the detector of electrons in the device. In the evening experiment on 20 April, energy spectra of electrons with a typical abrupt rise in intensity toward the region of low energies were observed. The amount of energy flow determined on the basis of this spectrum comprises about 0.3 ergs/sq cm sec. ster. The estimations of the energy flux of electrons in the remaining four tests led to values which were less by roughly an order of magnitude. Author

N72-14349# Joint Publications Research Service, Washington, D.C.
INTENSITY OF CORPUSCULAR RADIATION AND SOLAR ACTIVITY **c29**
V. F. Tulinov, Yu. N. Moiseyev, I. G. Shapiro, and L. A. Ulanova *In its* Invest. of the Atmosphere and Ionosphere during Period of increased Solar Activity 16 Dec. 1971 p 43-48 refs (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

Results are presented of a series of rocket measurements to a height of 95 km. of intensity of corpuscular radiation with the aid of Geiger end-window counters from 16 to 23 April. Considerable variations in corpuscular flows (in the range of 1-1.5 orders of magnitude) were observed. It was established that the increase in particle intensity is accompanied by a softening of energy spectrum. Author

N72-14350# Joint Publications Research Service, Washington, D.C.
IONIZATION OF E REGION OF FLUXES OF OUTPOURING ELECTRONS **c29**
G. S. Ivanov-Kholodnyy and T. V. Kazachevskaya *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 49-54 refs (See N72-14344 05-13)
(UDC-551.510.535+537.56) Avail: NTIS

The parameters of energy and flow spectrum of scattering electrons and their influence on the ionization of the upper atmosphere in the middle latitudes are examined. A comparison is made of ionization in the E-region by electron streams and by solar ultraviolet radiation. Author

N72-14351# Joint Publications Research Service, Washington, D.C.
MEASUREMENTS OF IONIC COMPOSITION OF LOWER IONOSPHERE
A. D. Zhludko *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 55-60 refs (See N72-14344 05-13)
(UDC-551.510.535+537.56) Avail: NTIS

Measurements of ion composition in the E-region of the ionosphere were conducted on 18 and 20 April 1969 at 1700 hours local time, respectively. In both instances, the NO(+) and O(+) ions were prevalent. In a comparison of the data from the two experiments, it was established that after a magnetic storm, an increase in absolute ion concentrations at heights of around 100 km is observed, while the radio O2(+)/NO(+) decreased by three times. Author

N72-14352# Joint Publications Research Service, Washington, D.C.
RESULTS OF RADIOSONDE MEASUREMENTS OF IONOSPHERE
A. A. Kuminov and O. P. Kolomiytsev *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 61-76 ref (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

Data for vertical sounding of the ionosphere in the middle latitudes are analyzed for the effect of a solar flare on a number of ionospheric parameters. The observations were conducted on days after the solar flares. Based on ionograms, height-related profiles of the electron concentration were constructed. It was demonstrated that the condition of the ionosphere differed appreciably. In the active periods occurred higher values for the critical frequencies of regular layers of the ionosphere and the high-level gradients of electron concentrations; the height of sporadic formations in the E-region decreased preceptibly.
Author

N72-14353# Joint Publications Research Service, Washington, D.C.
ON EFFECT OF SOLAR FLARE ON F2 LAYER OF IONOSPHERE **c29**
O. P. Kolomiytsev and A. A. Kuminov *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 77-86 refs (See N72-14344 05-13)
(UDC-551.510.535+523.745) Avail: NTIS

Variations in the ionosphere occurring after solar flares are linked with the sun's corpuscular radiation and the condition of a neutral atmosphere at heights of the maximum F-layer in the middle latitudes. Estimations have been made of the composition, concentration and density of a neutral atmosphere and also of the energy flux of a corpuscular ionization source. It was found that the energy flux from this source at heights of the maximum F2 layer comprises about 0.5 ergs/sq cm x sec/1; the source caused an increase of around 17 percent in total density of the neutral atmosphere. Author

N72-14354# Joint Publications Research Service, Washington, D.C.
VARIATIONS IN PARAMETERS OF N (h)-PROFILES OVER MOSCOW FROM 18-23 APRIL 1969
A. A. Freyzon and B. S. Shapiro *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 87-101 refs (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

Based on data from terrestrial vertical sounding, a study was made of the ionosphere in the period from 18-23 April 1969. Introduced and analyzed were new additional indexes of perturbation frequencies and heights of f 2- and E-layers. An appreciable increase in ionization in the F 2- and E-layers was found; moreover, all the observed periods of positive perturbation were identified with preceding flares on the Sun and with a time shift averaging 39 hours, which corresponds to corpuscle velocities of 1100 km/sec. Bursts of absorption in the SID periods showed peaks in the aftersunset hours. In addition, results are presented of detailed calculations of the N(h)-profiles at the times of rocket launches. Author

N72-14355# Joint Publications Research Service, Washington, D.C.
SOLAR AND GEOPHYSICAL ACTIVITY FROM 20 MARCH TO 24 APRIL 1969 c29
Ye. V. Lavrova *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 102-116 (See N72-14344 05-13)
(UDC-551.510+523.745) Avail: NTIS

Solar, geomagnetic and ionospheric activities for the period from 20 March to 24 April 1969 are examined. A list is presented of the large chromospheric flares and their accompanying phenomena having occurred during this period. Synoptic charts of the Sun are included (rotations 1545 and 1546). Also indicated are the variations in critical frequencies for a series of stations during the disturbances on 23-25 March and 12-15 April, 18-23 April. Author

N72-14356# Joint Publications Research Service, Washington, D.C.
VARIATIONS IN INTENSITY OF CORPUSCULAR IONIZING RADIATION AND STATE OF IONOSPHERE c29
V. F. Tulinov, Yu. N. Moiseyev, I. G. Shapiro, and L. A. Ulanova *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 117-122 refs (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

Simultaneous rocket measurements of the intensity of corpuscular fluxes at heights to 90-95 km and of radiosounding of the ionosphere with the aid of a ground-based ionospheric station during intensive variability in solar activity are reported. It is demonstrated that a direct relationship exists between heightening of corpuscular flux intensity in the upper atmosphere and decrease in height of ionospheric E-layer. Author

N72-14357# Joint Publications Research Service, Washington, D.C.
EFFECT OF SOLAR FLARE ON IONIZATION OF F2-REGION c29
Yu. A. Romanovskiy *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 123-131 refs (See N72-14344 05-13)
(UDC-551.510) Avail: NTIS

Two types of ionospheric disturbances caused by solar flares were observed that induced significant ionospheric variations at low and middle latitudes at heights of 200 to 300 km. Formations of deep troughs in ion concentration in the equatorial and subauroral regions on the night side of the earth were caused by a reduction in O(+) ion concentrations. During ionospheric disturbance after a solar flare which did not cause geomagnetic perturbations, a trough of atomic and molecular ions formed in the middle latitudes on the illuminated side of the hemisphere. Author

N72-14358# Joint Publications Research Service, Washington, D.C.
ON VARIATIONS IN ATOMIC OXYGEN IN LOWER THERMOSPHERE BASED ON RESULTS FROM SUN-ATMOSPHERE TEST
A. A. Pokhunkov *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 132-140 refs (See N72-14344 05-13)
(UDC-551.510) Avail: NTIS

Results are presented on rocket measurements for the distribution of relative concentrations in O1 and O2 in the range of heights from 110-150 km based on data from three launchings conducted at middle latitudes. In the experiment on 21 April 1969, an increase in the relative concentration of O1 at a reduction in height from 130 to 115 km was detected. This monotonic state can be explained by the presence of an additional sporadic agent in the atmosphere capable of increasing the relative concentration of O1 in relation to O2 by 2-3 times. Author

N72-14359# Joint Publications Research Service, Washington, D.C.
ON REACTION OF STRATOSPHERE AND MESOSPHERE TO SPORADIC VARIATIONS IN SOLAR ACTIVITY c29
G. A. Kokin *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 141-148 refs (See N72-14344 05-13)
(UDC-551.510) Avail: NTIS

A series of launches of rockets for measuring the temperature to a height of 80-85 km and wind to a height of 50-55 km are reported. An analysis of the data obtained indicated that relative to a solar flare appreciable variations occur. Specifically, the heights of stratopause and mesopause increase; at the 45-50 km level, an intensification of wind accompanied by a powerful meridianal flow occurs. A correlation has been established between the temperature pattern, intensification of sun's radio radiation on the 10.7 cm wave, increase in flow of electrons with energies greater than 40 kev and also the height and depth of ionospheric E- and F- layers. Author

N72-14360# Joint Publications Research Service, Washington, D.C.
WIND REGIME IN LOWER THERMOSPHERE DURING CONDUCT OF SUN-ATMOSPHERE EXPERIMENT c20
I. A. Lysenko and A. D. Orlyanskiy *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 149-156 refs (See N72-14344 05-13)
(UDC-551.510.53) Avail: NTIS

The results of studying the wind regime of the upper atmosphere by radar tracking of meteor trails are reported. Measurements were conducted with the aid of a radar set operating under coherent-pulse regime at a frequency of 24 Mhz. A study was made of two mutually perpendicular components of wind velocity for each hourly interval. It was shown that wind speed during the evening and pre-evening hours from 18-23 April was appreciably higher than it was from 10-13 April. However, variation in wind direction was about the same. Author

N72-14361# Joint Publications Research Service, Washington, D.C.
FEATURES IN CIRCULATION OF ATMOSPHERE DURING SUN-ATMOSPHERE EXPERIMENT c20
R. F. Usmanov *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 157-171 refs (See N72-14344 05-13)
(UDC-551.510+523.745) Avail: NTIS

Synoptic charts, charts of baric topography to 30 mb, time-dependent sections of meridional and zonal wind components, and air temperatures are used to describe atmospheric circulation in April, 1969. A hypothesis is expressed concerning the possible link in the origin of tropical cyclones

with changes in solar activity, particularly with variations in solar constant under consideration of assumed anisotropy in solar radiation in interplanetary space. Author

N72-14362# Joint Publications Research Service, Washington, D.C.

DISCUSSION OF RESULTS OBTAINED FROM EXPERIMENT CONDUCTED

G. S. Ivanov-Kholodnyy, T. V. Kazachevskaya, G. A. Kokin, and V. V. Mikhnevich *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 172-184 refs (See N72-14344 05-13)
(UDC-551.510+523.743) Avail: NTIS

Measurements were made of corpuscular fluxes, structural parameters, and ion and neutral compositions of the atmosphere at heights ranging from 20 to 160 km. The series of rocket experiments was accompanied by simultaneous ground observations at the ionospheric stations and stations for radar tracking of meteor trails. A relationship was established between solar activity, corpuscular fluxes, ionization in the ionosphere and also the structure and circulation in the lower and upper atmosphere of Earth. Author

N72-14363*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.

AIRBORNE AURORAL DATA AND SATELLITE DATA ANALYSIS Final Report

S. B. Mende and R. H. Eather Oct. 1971 94 p refs
(Contract NAS2-6299)
(NASA-CR-114379) Avail: NTIS CSCL 03B

The photometric data taken during the 1969 CV990 expedition were analyzed. It was found that the so-called soft auroral zone extends right through the night side auroral zone. The soft precipitation is a permanent feature of the night side auroral zone and probably signifies the position of the plasma sheet. The harder auroras which include the conventional visible auroras occur less frequently. The intensity and mean energy of auroral electrons is correlated suggesting that the fluctuation in auroral intensity comes primarily from the variability of the acceleration mechanism rather than the variations in the particle population densities. During the 1969 CV990 expedition, coordinated data was taken with the particle experiments on OV1-18 and ATS-5 satellites. The satellite data was reduced to facilitate coordinated investigations with the airborne experimenters. The airborne photometric lambda 5200 NI data were analyzed and the effective life time was found to be 4.5 minutes. Author

N72-14364# Department of Energy, Mines and Resources, Ottawa (Ontario).

RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA. REPORT NO. 2: AGRICULTURE AND GEOGRAPHY

Dennis White, ed. 1971 34 p
(M75-2/2) Avail: NTIS

The recommendations of the Working Group on Agriculture and Geography concerning remote sensing in programs related to Canada's resources and environment are presented. The recommendations are that Canada should take advantage of the NASA ERTS project by establishing a station in Canada to receive the data. A national committee on remote sensing is required to facilitate the development of services, and to coordinate activities in program development, data dissemination, research programs, and training. F.O.S.

N72-14365# Department of Energy, Mines and Resources, Ottawa (Ontario).

RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA. REPORT NO. 3: ATMOSPHERIC CONSTITUENTS

Dennis White, ed. 1971 38 p refs
(M75-2/3) Avail: NTIS

The conclusions and recommendations of the Working Group on Atmospheric Constituents regarding the future role of Canada in the development of remote sensing, and its application to the problems of air pollution, are presented. Problem areas that appear amenable to study by remote-sensing methods are identified, an order of priority established, and existing and proposed instrumentation assessed. The Working Group has concluded that remote sensing from both orbital and aircraft platforms will undoubtedly play an important role in global and large-scale studies of pollutants and other atmospheric components, as suitable instrumentation becomes available. However, because of inadequate resolution, remote-sensing techniques will not replace ground-based local sampling in air quality management programs. Background papers prepared for the Working Group are included. Author

N72-14366# Department of Energy, Mines and Resources, Ottawa (Ontario).

RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA. REPORT NO. 7: ICE RECONNAISSANCE AND GLACIOLOGY

1971 44 p
(M75-2/7) Avail: NTIS

The application of satellite-borne remote sensors for reporting ice formations and glacier expanse is discussed. Rapid expansion of northern transportation has increased the requirements for accurate reporting of ice formations. The satellite program is complementary to current ice reconnaissance programs. Benefits resulting from the satellite observation program and details of the operation are included. Author

N72-14367*# Scientific Translation Service, Santa Barbara, Calif.

THE FEASIBILITY OF STUDYING ATMOSPHERIC POLLUTION WITH SATELLITES

K. Ya. Kondratyev Washington NASA Nov. 1971 11 p refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 9, 1970 p 3-9
(Contract NASw-2035)
(NASA-TT-F-13890) Avail: NTIS CSCL 04A

The possibilities of determining the gaseous components (sulfur dioxide, carbon monoxide, etc.) of atmospheric pollution from spectral measurements of the emitted thermal radiation are discussed. The available data show that this problem can be solved in principle. The necessity of a complex approach to solving this problem is discussed, and its close relation to the problem of thermal satellite sounding of the atmosphere is noted. Author

N72-14368*# Scientific Translation Service, Santa Barbara, Calif.

SOME RESULTS OF SPECTROPHOTOMETRIC MEASUREMENTS OF THE EARTH FROM THE SOYUZ-7 SPACECRAFT

K. Ya. Kondratyev, A. A. Buznikov, B. B. Vinogradov, V. I. Volkov, V. K. Gorgatko, O. I. Smoktiy, and V. M. Orlov Washington NASA Nov. 1971 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 195, no. 5, 1970 p 1084-1087
(Contract NASw-2035)
(NASA-TT-F-13892) Avail: NTIS CSCL 22C

The spectrophotometric measurements of the twilight atmosphere and the underlying surfaces made from the Soyuz 7 spacecraft by a modified manual RSS-2 spectrograph, are described and compared to those made by Soyuz 5. The comparison shows that the qualitative behavior of the monochromatic curves of the halo brightness was the same for both experiments. However, the absolute values of the brightness in the first experiment were 2 to 3 times smaller. The monochromatic brightness curves of both the previous experiment and the current experiment show an absence of noticeable depressions caused by aersol layers, localized at various levels in the atmosphere. Data on the spectra of various natural surfaces are also included. E.H.W.

N72-14369*# Scientific Translation Service, Santa Barbara, Calif.
RESULTS OF VISUAL OBSERVATION OF THE NIGHTTIME, TWILIGHT, AND DAYTIME HORIZON OF THE EARTH FROM THE SOYUZ-9 SPACECRAFT
K. Ya. Kondratyev, A. A. Buznikov, A. G. Nikolayev, Sevastyanov, and O. I. Smoktiy Washington NASA Nov. 1971 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 197, no. 3, 1971 p 574-577
(Contract NASw-2035)
(NASA-TT-F-13891) Avail: NTIS CSCL 04A

The characteristic features of the nighttime, twilight, and daytime horizons as observed from Soyuz-9 are presented, and their possible explanations are discussed. Author

N72-14370*# Techtran Corp., Glen Burnie, Md.
AN OBSERVATION OF MESOSPHERIC (NOCTILUCENT) CLOUDS FROM SPACE
K. Ya. Kondratyev, A. A. Buznikov, O. B. Vasilyev, and V. I. Sevastyanov Washington NASA Nov. 1971 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 197, no. 5, 1971 p 1066-1069
(Contract NASw-2038)
(NASA-TT-F-13893) Avail: NTIS CSCL 04A

Numerous advantages to investigating noctilucent clouds from an orbiting spacecraft rather than from ground stations are presented. The geometrical relationships involved in such observations and their effect on the observations are discussed. Examples of noctilucent cloud observation during Soyuz 9 flight are included. Author

N72-14371# Indian National Scientific Documentation Centre, New Delhi.
APPLICATION OF AERIAL METHODS IN GROUND WATER STUDIES
N. G. Kell 1971 294 p refs Transl. into ENGLISH of "Primenenie Aerometodov dlya Izucheniya Gruntovykh Vod" Leningrad, Izd. Akad. Nauk SSSR, 1962 Prepared for Dept. of Com., ESSA, and NSF
(Contract NSF C-466)
(TT-68-50638; TT-70-57236) Avail: NTIS

The problem of using aerial survey methods for ground water prospecting in desert, semidesert, and forest zones of the USSR is examined. The data were obtained during expeditions of the Laboratory of Aerial Survey Methods, which carried out special studies in Turkmenia, regions of the sub-Caspian lowlands, and in the northwestern territory of the Russian Plains. Decamouflaging indicators of ground water occurrence and methods of recognizing them on aerial photographs according to different landscape types are described. Author

N72-14372*# National Aeronautics and Space Administration, Washington, D.C.
ROTATION OF THE EARTH, DEFORMATION OF THE EARTH'S CRUST, AND SOLAR ACTIVITY
N. N. Pavlov Sep. 1971 24 p refs Transl. into ENGLISH of "Vrashcheniye Zemli, Deformatsiya Zemnoy Kory i Solnechnaya Aktivnost" in "Vsesoyuznaya Yubileynaya Konferentsiya Po Probleme Izucheniya Zemli Kak Planety Metodami Astronomii i Geofiziki" Kiev, Naukova Dumka Press, 1970 p 30-51 Conf. held at Poltava, UKR. SSR, 9-12 Oct. 1967
(NASA-TT-F-13878) Avail: NTIS CSCL 08E

Results of observations of the annual periodicity in changes in the earth's velocity of rotation by time services during the period from 1956 to 1964 are reported, taking into account a possible relation between the earth's velocity of rotation and deformation of the earth's crust. It is concluded that short-period oscillations in the longitude of individual blocks of the earth's crust occur. These longitude oscillations are shown to be the consequence of a rec. movement of the individual blocks relative to each other. Certain patterns are noted in the variations in the longitude difference between Europe and America during three solar activity cycles - namely, near the maximum Europe is shifted westward relative to America, while near the minimum it is shifted eastward. Author

N72-14373# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
ON THE EFFECT OF PORE PRESSURES ON SOIL-WHEEL INTERACTION
Leslie L. Karafiath Dec. 1971 37 p refs
(RM-528J) Avail: NTIS

Wheel loads generate pore pressures in soils when their moisture content exceeds a certain level. These pore pressures affect the development of failure zones that control interface stresses in soft soils. The differential equations of plasticity governing the geometry of failure zones have been expanded to account for pore pressures and appropriate algorithms have been developed for the numerical solution of these equations. Slip-line field geometries and wheel performance parameters are shown in an example for various degrees of shear mobilization and pore pressure parameters. The effect of pore pressures on wheel performance is considerable even in soils with weak pore pressure response. Author

N72-14374*# Scripta Technica, Inc., Washington, D.C.
THE HYDROXYL RADIATION PROBLEM AND WAYS TO SOLVE IT
V. I. Krasovskiy NASA Jul. 1971 16 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 1, 1971 p 54-65
(Contract NASw-2036)
(NASA-TT-F-13862) Avail: NTIS CSCL 04A

Various hypotheses are compared with data on the hydroxyl emission of the upper atmosphere that have been gathered over a period of 25 years. Basic rules for this emission are formulated, and ways for studying the still unresolved aspects of the problem are evaluated. Problems, which cannot be solved without direct investigations at the base of the thermosphere, are enumerated. Author

N72-14375*# Techtran Corp., Glen Burnie, Md.
MESOSPHERIC CIRCULATION AND NOCTILUCENT CLOUDS IN THE SPRING OF 1967
W. Shroeder Washington NASA Jun. 1971 6 p refs Transl. into ENGLISH from Beitr. Geophysik (Leipzig), v. 79, no. 6, 1970 p 489-492
(Contract NASw-2037)
(NASA-TT-F-13861) Avail: NTIS CSCL 04A

From the comparison of noctilucent cloud data (abbreviation: LN) and spring transition of wind of the mesosphere during the year 1967, it follows that the period in which noctilucent clouds were seen continuously only began after the spring transition of wind was complete. Furthermore it is shown that the characteristics of summer circulation will appear first at low altitudes of the atmosphere and ascend to the mesosphere later. Author

N72-14376*# Scientific Translation Service, Santa Barbara, Calif.
MODEL OF VARIATIONS IN THE DENSITY OF THE EARTH'S ATMOSPHERE AT ALTITUDES OF 30-80 Km
Yu. G. Sikharulidze and M. A. Butuzova Washington NASA Feb. 1971 16 p refs Transl. into ENGLISH from Kosmich. Issled., Akad. Nauk SSSR (Moscow), v. 8, no. 4, 1970 p 526-534
(Contract NASw-2035)
(NASA-TT-F-13854) Avail: NTIS CSCL 04A

In finding the control algorithm for the movement of a space vehicle in the atmosphere, the size and nature of possible deviations in atmospheric density from the standard is very significant. In this process, a model of density variations at altitudes of 30 - 80 km for latitudes 50 S to 50 N are considered. Overall deviation is shown as the sum of systematic and random components, the former including seasonal-latitudinal,

as well as daily variations. The separate components and the formulas derived for their computation were studied. The most unfavorable conditions of possible atmospheric conditions affecting vehicle trajectories to the greatest degree were determined.
Author

N72-14377*# *Techtran Corp., Glen Burnie, Md.*
EXPERIMENTAL EVIDENCE FOR THE EXISTENCE OF STREAMS OF THE IONS H(+), He(+), AND O(+) IN THE EXOSPHERE
A. P. Yaichnikov Washington NASA Jul. 1971 6 p refs Transl. into ENGLISH from Kosmich. Issled., Akad. Nauk SSSR (Moscow), v. 9, no. 2, 1971 p 307-309
(Contract NASw-2037)
(NASA-TT-F-13867) Avail: NTIS CSCL 03B

Sputnik Electron-4 carried a radio-frequency mass-spectrometer. This instrument recorded the ions H(+), He(+), O(+), and N(+) during the period July to September, 1964, at heights of 400 to 6,000 km in the exosphere. The streams of these ions varied because of change in the angle of the instrument axis to the velocity vector. From the calculated data on instrument orientation and data on variation in streams of these ions, maxima in ion streams were found which did not correspond to the minimum in attack angle. The amplitudes of these were found to depend greatly on the McIlvaine parameter, L. During certain hours of local solar time, these streams appeared to be directed toward the earth. Properties of the ion stream are consistent with existing concepts about electrical fields in the ionosphere, and may be useful in further theory development.
Author

N72-14378*# Translation Consultants, Ltd., Arlington, Va.
SOME RESULTS OF THE INTEGRATED COMPOSITE SUBSATELLITE GEOPHYSICAL EXPERIMENT
K. Ya. Kondratyev, A. A. Buznikov, O. B. Vasilyev, B. V. Vinogradov, A. A. Grigoryev, Yu Rabinovich, I., and L. I. Chapurskiy Washington NASA Nov. 1971 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR,(Moscow), v. 196, no. 6, 1971 p 1333-1336
(Contract NASw-2038)
(NASA-TT-F-13894) Avail: NTIS CSCL 08G

A brief overview is presented for results obtained from the joint mission of Soyuz 6 and 7 and LI-2 and IL-18 aircraft. Aerial photographs were taken and spectrophotometric measurements made of the earth's surface along the Caspian Sea - Ustyurt-Aral Sea line.
K.P.D.

N72-14379# National Aeronautical Establishment, Ottawa (Ontario).
STRATOSPHERIC TURBULENCE AND TEMPERATURE GRADIENTS MEASURED BY AN RB-57F: COLDSCAN FLIGHTS 57 TO 92
J. I. MacPherson and E. G. Morrissey Oct. 1971 81 p refs
(NRC-12318; LR-551) Avail: NTIS

Throughout most of the period from January 1969 to June 1971, high altitude weather reconnaissance aircraft carried special instrumentation to measure and record stratospheric turbulence and horizontal temperature gradients encountered on routine flights at altitudes from 40,000 to 65,000 feet. The purpose was to collect data at altitudes to be flown by supersonic transports. Eighty-eight missions were flown covering over 136,000 nautical miles. A summary of the results of all the flights is included. Data are presented on the correlation between measured stratospheric turbulence and horizontal temperature gradients, on the altitude and geographical distributions of the turbulence and temperature change encounters, and on the positions of the recorded incidents relative to the jet stream. Detailed accounts are given of a selection of 15 events from flights 57 through 92 that showed significant temperature gradients or light to moderate turbulence. These presentations include time histories of the recorded variables, flight tracks showing event positions, and meteorological analyses.
Author

N72-14380# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
CHLORINE AND AIR POLLUTION: AN ANNOTATED BIBLIOGRAPHY
Jul. 1971 116 p refs
(AP-99) Avail: SOD $0.55 as 5503-0018

This bibliography contains 162 abstracts of documents and articles on chlorine. These abstracts are numbered sequentially. An author index, a title index, a subject index, and a geographical location index follow the abstracts. The author index lists all authors individually. The indexes refer to the abstracts by number.
Author

N72-14381# Institut d'Aeronomie Spatiale de Belgique, Brussels.
A LOOK AT THE STRATOSPHERE [UN REGARD SUR LA STRATOSPHERE]
M. Nicolet 1971 28 p refs In FRENCH; ENGLISH summary
(A-N-91-1971) Avail: NTIS

The nature of the minor constituents which may have a controlling effect on the stratospheric ozone is discussed. It is shown that all reactions involve atomic oxygen which is in photochemical equilibrium with ozone. In the lower stratosphere dynamic aspects must be introduced since there is a complete departure from photochemical equilibrium conditions which require several years. The reaction of atomic oxygen with methane and nitrous oxide leads to a destruction of these two molecules which corresponds to a production of stratospheric water vapor and nitric oxide, respectively. A comparison is made between the stratospheric production of water vapor through the destruction of methane and of nitric oxide, through the destruction of nitrous oxide and the injection of water vapor, and of nitric oxide at stratospheric levels by 500 supersonic jets.
Author

N72-14382# Institut d'Aeronomie Spatiale de Belgique, Brussels.
NITROUS OXIDE IN THE STRATOSPHERE [L'OXYDE AZOTEUX DANS LA STRATOSPHERE]
M. Nicolet and E. Vergison 1971 19 p refs In FRENCH; ENGLISH summary
(A-N-90-1971) Avail: NTIS

The formation of nitric oxide in the lower stratosphere is due to the reaction of nitrous oxide with the excited oxygen D singlet atom. The total production of NO molecules is related to the eddy diffusion coefficient in the stratosphere which is required to sustain N2O subject to photodissociation. With eddy diffusion coefficients between 1000 and 10,000 sq cm/sec, the natural production of nitric oxide molecules is of the same order of magnitude as occurs with artificial injection in the lower stratosphere by 500 supersonic jets.
Author

N72-14383# Institut d'Aeronomie Spatiale de Belgique, Brussels.
PHOTOCHEMISTRY OF OZONE IN THE STRATOSPHERE UNDER THE INFLUENCE OF NITROGEN OXIDES AND HYDROGEN COMPOUNDS [PHOTOCHIMIE DE L'OZONE DANS LA STRATOSPHERE SOUS L'ACTION DES OXYDES D'AZOTE ET DES COMPOSES DE L'HYDROGENE]
M. Nicolet 1971 30 p refs In FRENCH; ENGLISH summary
(A-N-89-1971) Avail: NTIS

The nature of the minor constituents which may have a controlling effect on the stratospheric ozone is discussed and the results of calculation are given. It is shown that there is practically no direct action on the ozone molecules. All reactions involve atomic oxygen in photochemical equilibrium with ozone. A catalytic destruction of ozone by water vapor occurs through reactions of hydroxyl and hydroperoxyl radicals produced in the oxidation of H2O by excited oxygen atoms O1D. With mixing ratios greater than 3 ppmy, water vapor represents a significant ozone-destroying agent in the upper stratosphere. The catalytic destruction by nitrogen oxides requires a concentration of NO2 molecules greater than 10 to the 9th power/cu cm above 25 km.
Author

N72-14384*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
MAGNETOTAIL CHANGES IN RELATION TO THE SOLAR WIND MAGNETIC FIELD AND MAGNETOSPHERIC SUBSTORMS
Michel P. Aubry (Groupe de Rech. Ionospheriques) and Robert L. McPherron 4 Dec. 1970 48 p refs Submitted for publication Sponsored in part by ESRO
(Contract NAS5-9098; Grant NGR-05-007-004)
(NASA-CR-124843; Publ-888) Avail: NTIS CSCL 03B

An attempt is made to understand some of the magnetotail dynamics by using simultaneous observations from several satellites: Explorers 33 and 35 in the solar wind, IMP 4 in the near magnetotail (30 RE), ATS 1, and OGO 5 in the magnetosphere. It was observed that in the main lobes of the tail the magnetic field increases slowly when the interplanetary magnetic field turns southward, and can decrease slowly after a substorm. The plasma sheet changes indicate a thinning when the interplanetary magnetic field turns southward and an expansion when it turns northward. When combined with the plasma sheet expansion, which has been observed to follow a substorm, these results allow a schematic view of the relations between the changes in the orientation of the solar wind magnetic field, the substorms, and the changes in the tail parameters to be developed. Author (ESRO)

N72-14385# Los Alamos Scientific Lab., N.Mex.
DEPENDENCE OF THE NEUTRON MONITOR ATTENUATION COEFFICIENT ON ATMOSPHERIC DEPTH AND ON GEOMAGNETIC CUTOFF IN 1966 AND IN 1970
Hugh Carmichael (Atomic Energy of Can., Ltd.) and R. W. Peterson [1971] 6 p refs Presented at the 12th Intern. Conf. on Cosmic Rays, Hobart, Australia
(LA-DC-12693; CONF-710807-1) Avail: NTIS

Measurements with a mobile overland 3-NM-64 neutron monitor and with an airborne IGY-type neutron monitor made at altitudes between sea level and 40,000 feet in 1966 soon after solar minimum and in 1970 near solar maximum, at geomagnetic cutoffs between 0.5 and 13.3 GV, were analyzed to find the rate of attenuation of the counting rate throughout the atmosphere. The maximum attenuation observed near the atmospheric depth of 600 mm Hg is discussed in detail. Author (NSA)

N72-14386# Adelaide Univ. (Australia). Dept. of Physics.
OZONE DETERMINATIONS BY LUNAR ROCKET PHOTOMETRY
J. H. Carver, B. H. Horton, R. S. OBrien, and Bryan Rofe Jun. 1971 16 p refs
(ADP-106) Avail: AEC Depository Libraries

Atmospheric ozone number densities were determined over the altitude range 30 to 75 km by measuring the absorption of lunar ultraviolet radiation in a number of wavelength bands between 2400 and 2900 A. The measurements, made from rockets fired at night at times close to full moon, show significant variations in ozone densities particularly at the higher altitudes. Comparison with other observations indicates that, above 60 km, the ozone densities at night are markedly greater than they are during the day. Author (NSA)

N72-14387# Environmental Research Corp., Las Vegas, Nev.
OBSERVED SEISMIC DATA, FLASK EVENT
Lewis R. West and Raymond K. Christie, comps. Mar. 1971 80 p refs
(Contract AT(29-2)-1163)
(NVO-1163-233) Avail: NTIS

The results of the processing of the observed ground motion from the Flask event, an underground nuclear detonation of Yucca Flat, at the United States Atomic Energy Commission's Nevada Test Site are presented. Ground motion data recorded at instrument stations deployed by the National Ocean Survey and EG&G were processed and compiled. Pseudo-relative velocity spectra at 5% damping were derived from the velocity seismograms. Author (NSA)

N72-14388# European Space Research Inst., Frascati (Italy).
ON THE EQUILIBRIUM CONFIGURATION OF THE GEOMAGNETIC TAIL
G. H. A. Cole (Hull Univ., Engl.) and Karl Schindler [1971] 17 p refs Submitted for publication
Avail: NTIS

Conditions of momentum balance in the geomagnetic tail are investigated on the basis of a simple steady two-dimensional model. It is concluded that available observations on the tail structure can be explained within this frame-work during times when the tail is sufficiently quiet. It is shown that the existence of a finite plasma sheet appears as a consequence of the observed magnetic field variation along the tail. Given present observations, pressure anisotropy and waves are not likely to contribute significantly to the momentum balance along the tail. It is concluded further that there is a need for more detailed observational data to help to assess the validity of the present model. Author (ESRO)

N72-14389# Texas Univ., El Paso.
SOUND INTENSITY IN ATMOSPHERIC SHADOW ZONES ASSUMING A CONSTANT VELOCITY GRADIENT Final Technical Report, 1 Jul. - 30 Sep. 1970
Phillip H. Duran Dec. 1970 272 p refs
(Contract DAAD07-69-C-0359)
(AD-728836; ECOM-0359-F2) Avail: NTIS CSCL 20/1

A simplified mathematical model is completed which will give the shadow zone sound intensities in a medium similar to the earth's atmosphere. The assumed medium is an infinite fluid half-space in which the sound velocity decreases linearly with distance from a rigid plane surface. This model can now be extended to include new meteorological variables, such as wind and temperature gradients and variable sound velocity gradients. Analytical solutions are obtained for the velocity potential integrals for sound propagation above and below the point source. A method is developed for calculating the small and large zeros of complex Bessel expression I%(X) + 2 x 13 (x) for generally complex order and argument. The intensity solution is an infinite sum of residues which converges rapidly at the shadow boundary and gives much smaller intensities inside the shadow zone. Large-scale plots of the sound field illustrate some characteristics of the shadow zones. Tables of the residues are reported, containing the first fifty terms in the series solution at several points of the sound field. Values of JK(z) + ZJ<Z for large real and complex order are also tabulated. Author (GRA)

N72-14390# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBE METHODS OF STUDYING THE IONOSPHERE
G. L. Gdalevich 29 Jun. 1971 46 p refs Transl. into ENGLISH from Ionosfernye Issled., Sb. Statei (Moscow), no. 18, 1969 p 95-119
(AD-729082; FTD-MT-24-125-71) Avail: NTIS CSCL 04/1

Probing is the main technique used for investigating the gas-discharge plasma (comparatively cold plasma with a rather low concentration and weak magnetic fields). Characteristics obtained from probing (dependences of probe current upon voltage applied to a probe) may, in the main, be used for determining all the basic parameters of plasma, such as: electron and ion concentration, distribution of ions and electrons according to their energies and plasma potential in the area of the probe. Measurements carried out by means of probing allow the local parameters of the ionospheric plasma to be determined, the results of such measurements being independent of the condition of the medium between the probing means and the Earth. In principle this advantage of measurements carried out by means of probing allow their utilization at any altitude. However, apart from difficulties encountered in the gas-discharge plasma, a number of difficulties which pertain particularly to the ionosphere may arise during measurements by means of probing. Author (GRA)

N72-14391# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.

ON THE LINEARIZATION OF THE GEODETIC BOUNDARY VALUE PROBLEM

Peter Meissl May 1971 79 p refs

(Contract F19628-69-C-0127; AF Proj. 7600)

(AD-728632; DGS-152; AFCRL-71-0295; SR-15; DoD-Element-62101F; DoD-Subelement-681000) Avail: NTIS CSCL 08/5

The geodetic boundary value problem consists in determining an unknown closed surface from the boundary values of an external potential and its gradient. A rigorous mathematical formulation of this problem is given leading to a system of non-linear integro-differential equations. The formalism of differentiation in function spaces is applied yielding a linearized version which involves no further neglections and approximations. Tensor calculus is used in linearizing the various differential geometric quantities. The results are specialized to a linearization with respect to the equipotential sphere in which case the formulas of Stokes and Vening Meinesz are simultaneously obtained. Author (GRA)

N72-14392# Texas A&M Univ., College Station. Dept. of Oceanography.

DEEP SCATTERING LAYERS IN THE GULF OF MEXICO

Ronald C. Thompson, Jerald W. Caruthers, and Thomas J. Bright Feb. 1971 67 p refs

(Contract N00014-68-A-0308-0002; NR Proj. 083-036; A/M Proj. 700-14)

(AD-729256; A/M-Ref-71-5-T) Avail: NTIS CSCL 20/1

The deep scattering layer (DSL) in the Gulf of Mexico has been studied, over a period of three years, utilizing a precision depth recorder operating at 12 kHz. The DSL appears to be divided into four main daytime layers. The west-central Gulf shows little deep layering. No definite correlation of DSL and physical parameters was arrived at. The DSL was not found to be seasonally variable. There were some indications that the DSL shoals to the north. Maximum rates of evening ascent of 3.4 fm/min (6.2 m/min) and morning descent of 5.9 fm/min (10.8 m/min) were determined. The length of time for ascent (2 hr) and descent (3 1/2 hr) are arrived at. Examples of evening ascent, morning descent and the dawn rise are presented. Response of the DSL to a total solar eclipse and cloud cover are discussed. Author (GRA)

N72-14393# Regional Research Associates, Inc., Ann Arbor, Mich.

SPATIAL SAMPLING: A TECHNIQUE FOR ACQUISITION OF GEOGRAPHIC DATA FROM AERIAL PHOTOGRAPHS AND MAPS Final Report

Gunnar Olsson 8 May 1971 256 p refs

(Contract DAAK02-70-C-0298; DA Proj. 4A0-061102-B-52-D)

(AD-725612; ETL-CR-71-11) Avail: NTIS CSCL 08/6

Modern remote sensing techniques have produced such large numbers of images that conventional analytic and evaluative procedures are no longer sufficient. Existing spatial sampling techniques were investigated to see if information could be retrieved in a less costly and time-consuming manner. More specifically, the purpose of the project was to determine whether available techniques could be used for identifying and measuring geographic features as they are depicted on maps and aerial photographs. This final report includes 6 appendices: spatial sampling, an annotated bibliography; problems in spatial sampling; error components in scientific model building statistical properties of spatial distributions; large scale variations in spatial data; and empirical experiments in sampling of spatial phenomena. Author (GRA)

N72-14394# Air Force Cambridge Research Labs., Bedford, Mass.

APPLICATION OF VECTOR AND MATRIX METHODS TO TRIANGULATION OF CHEMICAL RELEASES IN THE UPPER ATMOSPHERE

Antonio F. Quesada 23 Apr. 1971 61 p refs

(AF Proj. 7635-13-01)

(AD-729448; AFCRL-71-0233; AFCRL-ERP-351; DoD-Element-62101F; DoD-Subelement-681000) Avail: NTIS CSCL 04/1

The methodology of vector and matrix algebra has been used to simplify the triangulation procedures required to determine the position, motion, and growth of luminescent gas clouds injected into the upper atmosphere. Generated by chemicals discharged from rockets programmed to effect point or continuous releases at preselected times, such clouds have proved to be a powerful experimental tool for gathering data relevant to upper atmosphere phenomena such as winds, wind shears, and turbulent transport mechanisms, and the production, maintenance, and decay of ionization in support of specific Air Force requirements in satellite operations, missile detection, and communications. Author (GRA)

N72-14395# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Library Section.

CHOICE OF THE OPTIMUM NUMBER OF GRAVIMETERS FOR SIMULTANEOUS OBSERVATIONS

G. T. Sobakar Jul. 1971 9 p refs Transl. into ENGLISH from Geofiz. Sb., Akad. Nauk Ukr. SSR, Inst. Geofiz. (Ukrainia SSR), no. 34, 1970 p 48-50

(AD-729556; ACIC-TC-1748) Avail: NTIS CSCL 08/14

On the basis of the reliability coefficients of gravimeters and theorems of the probability theory, the solution of the problem of a set of gravimeters for simultaneous observations is given. It is shown that the optimum number of gravimeters with high reliability coefficients is equal to three. An increase in the number of gravimeters results only in complication and rise in the cost of a gravimetric survey. Author (GRA)

N72-14396# Denver Research Inst., Colo.

STUDY OF THE CHARACTERISTICS OF ULF-ELF FLUCTUATIONS OF THE GEOMAGNETIC FIELD Final Report, 1 Jan. 1967 - 31 Dec. 1970

George L. Mason 1 May 1971 74 p refs

(Contract F19628-67-C-0108; AF Proj. 8601-07-01)

(AD-729474; DRI-2561; AFCRL-71-0144) Avail: NTIS CSCL 08/14

Occurrence data for Pc1-2 and Pi type micropulsations observed at the high-latitude station, Barrow, Alaska, are grouped and analyzed by seasons, i.e., Summer and Winter Solstitial periods and Equinoctial periods. Other topics discussed include: possible correlation among high latitude Pc1-2, Pi, and middle latitude Pc1; apparent westward drift of Pc1 initiation; asymmetric interhemisphere phase shift in Pc1 type events; and 1967 comparative octave-band data for high-latitude and equatorial stations Barrow and Huancayo respectively.

Author (GRA)

N72-14397# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

FLUID MOTIONS AND SOME OF THEIR EFFECTS

Ernest Bauer, Philip A. Selwyn, and C. M. Tchen Jul. 1971 76 p refs

(Contract DAHC15-67-C-0011)

(AD-729640; P-756; IDA/HQ-71-12329) Avail: NTIS CSCL 04/1

The report discusses the fluid mechanical motions of various time scales which affect the chemical and energy balance in the earth's upper atmosphere, with particular application to the oxygen dissociation in the lower thermosphere. First the equations of fluid mechanics of the individual species and of the total gas are written down and some useful approximations are discussed, and the long-term or dominant motions, the general circulation and steady winds, are taken up. Next, solutions of the linearized equations for wave motions--the tides and other acoustic-gravity waves--are discussed, treating in turn theory, observations, and possible implications for aeronomy. After that, the origin of turbulence arising from the non-linearity of the hydrodynamic

equations is pointed out, the spectrum of atmospheric turbulence is indicated briefly and the general character of atmospheric diffusion is discussed. Finally, the interaction of turbulence and chemistry is treated, with emphasis on the limitations of present analyses. Author (GRA)

N72-14398# Notre Dame Univ., Ind. Coll. of Engineering.
DEEP SEA ENGINEERING Progress Report, 1 Jan. - 31 Aug. 1971
Edward W. Jerger and Joseph C. Hogan Sep. 1971 46 p refs
(Contract N00014-68-A-0152; Proj. Themis)
(AD-730066) Avail: NTIS CSCL 13/10

Contents: Undersea jet propulsion system and related studies; Natural convection heat and mass transfer in a temperature and concentration-stratified environment; Viscoelastic effects on the turbulent boundary layer of submerged flat plate; Turbulent free-convection boundary layers along a vertical plate; Gas lubrication; Mechanics of submerged structures; Finite element method for elasto-plastic analysis of cylindrical shells with cutouts; The dynamics of tethered submersibles; Magnetostrictive transducers; Magnetostriction and magneto-mechanical coupling studies of rare-earth cobalt intermetallics.
GRA

N72-14399# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
F-SCATTERING AND SHORT PERIOD PULSATIONS OF THE EARTH'S ELECTROMAGNETIC FIELD BASED ON OBSERVATIONS AT IRKUTSK
G. V. Vergasova and V. D. Kokourov 20 Jul. 1971 14 p refs Transl. into ENGLISH from publ. "Issledovaniye Ionosfery" Novosibirsk, Izd vo Nauka, 1970 p 140-146
(Contract F33657-71-D-0057; AF Proj. M122)
(AD-730070; FTD-HC-23-334-71; UR/0000-70-000-000) Avail: NTIS CSCL 08/14

The preliminary results of the investigation of the relation between F-scattering and pearl-type pulsations are presented. The data used here for the scattering and short-period pulsations (SPP) were taken from tellurograms and ionograms which were obtained in the laboratories of the Siberian Institute of Terrestrial Magnetism, the Ionosphere and the Propagation of Radio Waves associated with the Academy of Sciences of the USSR (Sibizmir so an SSSR) during the period of the vernal equinox from 1959 through 1963. Basically an amplitude-frequency analysis was carried out. The results of the studies are presented in the form of tables and graphs. A comparison is given of the intensities and duration of the phenomena being investigated.
Author (GRA)

N72-14400# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GEOMAGNETIC FIELD OF THE BLACK SEA BASIN
Ya. P. Malovitskii, B. D. Uglov, and G. V. Osipov 26 Jul. 1971 21 p refs Transl. into ENGLISH from Geofiz. Sb., Akad. Nauk Ukr. SSR, Inst. Geofiz. (Kiev), no. 32, 1969 p 28-38
(AF Proj. M122)
(AD-730077; FTD-HC-23-368-71; UR/0000-69-000-032) Avail: NTIS CSCL 08/14

Observations were made with a sea proton magnetometer along meridional profiles; the average distance between profiles was about 28 km. On some profiles special echo sounders were employed for highly precise depth measurements. Horizontal control of the profiles was with an RSVT-1 radiogeodetic system, as well as by navigation and astronomical methods. Survey data were used in compiling a map of given magnetic field anomalies for a large part of the Black Sea. Five large zones were defined which differ in amplitude, periods and strike of anomalies. Quantitative computations of the parameters of magnetically disturbing bodies were made for determining the geologic nature of 14 anomalies. Comparison of these data with deep seismic sounding data indicates an adequate reliability of determining depth to the upper surface of disturbing bodies. Author (GRA)

N72-14401# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Library Section
ISOSTASY OF THE BERING SEA
A. G. Gainanov, E. N. Isaev, P. A. Stroev, and S. A. Ushakov Jun. 1971 12 p refs Transl. into ENGLISH from Geofiz. Byull. (Moscow), no. 20, 1969 p 15-19
(AD-728302; ACIC-TC-1747) Avail: NTIS CSCL 08/7

The study of the deep-seated structure and dynamics of the earth's crust and upper mantle requires knowledge of isostasy. Among all forms of gravity reductions, the abyssal heterogeneities are most clearly reflected in the isostatic anomalies. The analysis of the latter is especially effective in the areas of the most active tectonics. One such area is the peripheral belt of the Pacific Ocean. A calculation and analysis of isostatic anomalies, pertaining to the transition area from the Asiatic and American continents to the northern part of the Pacific Ocean, were performed by the authors. The region of investigation is interesting because it includes almost all the most characteristic elements of the relief of transition zones, such as continental shelf and slope, marinal sea, island arc, abyssal trench, marginal oceanic swell, and underwater ridges. In addition, the shelf of the Bering Sea is the connecting continental link between Asia and North America, and this makes it possible to consider it as a subsided part of the continent. Author (GRA)

N72-14402# Aerojet-General Corp., El Monte, Calif. Microwave Div.
MICROWAVE RADIOMETRIC DETECTION OF OIL SLICKS Final Report, 12 Jun. 1970 - 28 Feb. 1971
D. C. Meeks, D. P. Williams, R. M. Wilcox, and A. T. Edgerton Mar. 1971 103 p refs
(Contract DOT-CG-93228-A; USCG Proj. 714104/A/002)
(AD-728551; AGC-1335-2; FR-2) Avail: NTIS CSCL 13/2

Two years of research have been conducted to determine the feasibility of using microwave radiometry for the detection, identification, and surveillance of oil pollution. Theoretical studies consisted of a review of contemporary theory concerning parameters that influence microwave emission from both unpolluted and oil-covered seas. Laboratory investigations confirm results obtained from earlier studies and established the response characteristics of the 3.2-mm sensor to continuous oil films. Airborne measurements of controlled spills off the Southern California Coast were performed with dual-polarized 3.2- and 8.1-mm sensors oriented with a forward antenna viewing angle 45 deg above nadir. Four sets of oil spills, or missions, were performed to obtain data over a variety of sea-surface conditions. Pollutants used for the tests included No. 2 diesel fuel, 26.1 and 21.6 API gravity crude oils, and 9.7 API gravity fuel oil. Significant microwave brightness temperature oil slick signatures were noted for a wide range of ocean conditions (sea states 1-4) and oil film thickness (thickness + 1 micron and greater). Based on the experimental results a passive microwave imaging system configuration has been recommended for oil pollution surveillance. Author (GRA)

N72-14403# Air Weather Service, Scott AFB, Ill.
A STUDY OF STRATOSPHERIC EMITTERS BASED ON INFRARED RADIOMETERSONDE MEASUREMENTS
Serhij Pilipowskyj and James A. Weinman Aug. 1971 65 p refs
(AD-729764; AWS-TR-221) Avail: NTIS CSCL 04/1

Analysis of downward-directed infrared irradiances measured in the lower stratosphere indicated that reasonable limits on the gaseous components of the atmosphere were not able to account for the irradiances observed between 14 and 24 km. Additional emitters were therefore assumed to exist at these altitudes. Information on the spatial and temporal distributions of the stratospheric emitter was obtained from an analysis of some 400 measurements taken during the 1962-1967 period. The results indicate that while this phenomenon is global in scope, it is most evident in the tropics at altitudes between 15 and 18 km. Time series of daily radiometersonde ascents carried out during the Line Islands Experiment indicated that the emitter has a high persistence in the tropics. A series of

synoptic-scale ascents made over the central United States on one night indicated that the emitter has a great variability in the mid-latitudes. No long-term trends in the concentration of the emitter in the tropics or in the mid-latitudes could be determined. Author (GRA)

N72-14404# Advanced Research Projects Agency, Washington, D.C.
COPIES OF PAPERS PRESENTED AT WOOD'S HOLE CONFERENCE ON SEISMIC DISCRIMINATION, VOLUME 2
1971 372 p refs Conf. held at Wood's Hole, Mass., 20-23 Jul. 1970
(AD-729248; ARPA-TIO-71-11-Vol-2) Avail: NTIS HC$6.00/MF $0.95 CSCL 08/11

Contents: Simulation of discrimination analysis; Theory of seismic source; Deduction of seismic source parameters from long period waves; Source dimensions of nuclear explosions and small shallow earthquakes; Comparison of P-wave spectra of underground explosions and earthquakes; Tectonic strain release and the monitoring of underground nuclear explosions. GRA

N72-14405# Lamont-Doherty Geological Observatory, Palisades, N.Y.
HIGH GAIN, LONG PERIOD SEISMOGRAPH STATION INSTALLATION REPORT, EILAT, ISRAEL
Tracy L. Johnson 31 Mar. 1971 58 p refs
(Contract F44620-70-C-0038; ARPA Order 1513)
(AD-729899; AFOSR-71-2371TR) Avail: NTIS CSCL 08/11

The report describes the installation of a high-gain, long-period seismograph system at Eilat, Israel. The station is located at 29.33 degrees North latitude, 34.57 degrees East longitude at an elevation of about 200 m above sea level in the same tunnel as the World Wide Standardized Seismic Network (WWSSN) station EIL. The system consists of three Geotech seismometers with natural periods of 30 sec (one vertical and two horizontal) each with two velocity transducers and one displacement transducer. Author (GRA)

N72-14406# Lamont-Doherty Geological Observatory, Palisades, N.Y.
HIGH GAIN, LONG PERIOD SEISMOGRAPH STATION INSTALLATION REPORT, CHIANG MAI, THAILAND
Andrew J. Murphy 31 Mar. 1971 68 p refs
(Contract F44620-70-C-0038; ARPA Order 1513)
(AD-729898; AFOSR-71-2367TR) Avail: NTIS CSCL 08/11

This report describes the installation of a high-gain, long-period seismograph system at Chiang Mai, Thailand. The station is located at 18 degrees 47 min. 24 sec. north latitude, 98 degrees 58 min. 37 sec. east longitude, at an elevation of 416 m above sea level in a concrete surface vault adjacent to the World-Wide Standardized Seismic Network (WWSSN) station CHG instrument vault. The system consists of three Geotech seismometers with natural periods of 30 sec (one vertical and two horizontal) each with two velocity transducers and one displacement transducer. Author (GRA)

N72-14407# Lamont-Doherty Geological Observatory, Palisades, N.Y.
LONG PERIOD SEISMOLOGICAL RESEARCH PROGRAM Final Report
Lynn Sykes 30 Apr. 1971 32 p refs
(Contract F44620-70-C-0038; ARPA Order 1513)
(AD-729897; AFOSR-71-2369TR) Avail: NTIS CSCL 08/11

Four long-period, high-gain, three-component seismograph systems were designed, constructed and installed in Alaska, Australia, Israel, and Thailand. A fifth station is being installed in Spain. These instruments have peak response of 500,000 at periods of 35 to 45 seconds. This high sensitivity is achieved by isolating the seismometer from barometric changes, by electronically filtering out the six-second microseisms and by shaping the instrument response to correlate with a natural minimum in the earth-to-noise spectrum. Data from Alaska, Australia, and the prototype instrument in New Jersey are sufficient for detecting Rayleigh waves from all earthquakes with a body wave magnitude of from 3.8 at distances of about 0 to 15 degrees to 4.7 at distances greater than 100 degrees. The minimum detectable magnitude is also a function of geographic location. A minimum is found in the spectral amplitude of earth noise between 30 to 40 seconds at all sites. The lowest level of the noise was observed in Thailand. G waves and inversely dispersed Rayleigh waves are commonly observed for events as small as M(b) approximately equal to 5. Free oscillations lasting for over 24 hours were observed following an event of magnitude 7.3. Author (GRA)

N72-14408# Lamont-Doherty Geological Observatory, Palisades, N.Y.
HIGH GAIN, LONG PERIOD SEISMOGRAPH STATION INSTALLATION, CHARTERS TOWERS, AUSTRALIA Interim Report
John M. W. Rynn 31 Mar. 1971 79 p refs
(Contract F44620-70-C-0038; ARPA Order 1513)
(AD-729901; AFOSR-71-2368TR) Avail: NTIS CSCL 08/11

The report describes the installation of a high-gain, long-period seismograph system at Charters Towers, Australia. The station is located at 20 degrees 05 min. 18 sec. south latitude, 146 degrees 15 min. 16 sec. east longitude at an elevation of 356 m above sea level in the same tunnel as, and adjacent to, the World Wide Standardized Seismic Network (WWSSN) station CTA instrument vault. The system consists of three Geotech seismometers with natural periods of 30 sec (one vertical and two horizontal) each with two velocity transducers and one displacement transducer. Author (GRA)

N72-14409# Weidlinger (Paul) Consultants, New York.
INVESTIGATION OF GROUND SHOCK EFFECTS IN NONLINEAR HYSTERETIC MEDIA. REPORT 5: COMPUTER CODE COMPUTATIONS AND COMPARISON WITH THEORETICAL SOLUTIONS: VARIABLE MODULI MATERIAL
Alva T. Matthews and M. L. Baron Aug. 1971 33 p refs
(Contract DACA39-67-C-0048)
(AD-730767; AEWES-CR-S-68-1-5; Rept-5;
NWER-Subtask-SB209) Avail: NTIS CSCL 08/13

This report is the fifth in a series concerning the development and evaluation of variable moduli material models and their application to ground shock calculations for soil type media. This report presents a comparison of the numerical results obtained with the axisymmetric LAYER code and the plane strain code for the plane strain theoretical solutions of Ref. (8). In each case, the same variable moduli material model was prescribed for the half-space. It is seen that the analytical and numerical results agree quite well, Thus indicating that the material models in the codes are performing correctly. Author (GRA)

N72-14410# Little (Arthur D.), Inc., Cambridge, Mass.
EXPERIMENTAL AND THEORETICAL STUDIES OF LONG-PERIOD TILT OF EARTH'S CRUST. PART 1: EXPERIMENTAL Final Report, 9 Dec. 1969 - 9 Jul. 1971
Ivan Simon 9 Jul. 1971 78 p refs
(Contract F19628-70-C-0080; AF Proj. 8607)
(AD-729916; AFCRL-71-0388-Pt-1; DoD-Element-61102F; DoD-Subelement-681300) Avail: NTIS CSCL 08/7

A three-element borehole tiltmeter system was developed and installed at Bedford, Massachusetts for the purpose of measurement and analysis of crustal tilts. Each borehole unit contains two single-axis tiltmeters with diamagnetically suspended masses and leveling motors adapted for stepwise calibration in situ. Individual wellhead electronic units contain regulated power supplies, low-pass filter-amplifiers and controls for remote leveling. Output signals are transmitted by cables to a central terminal where they are monitored with strip-chart recorders and recorded by a multi-channel digital tape recorder. The three boreholes, 50 to 56 ft. deep and approximately 600 feet apart, are in a compact, foliated granitic gneiss overlain by 3 to 10 ft. of

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overburden. They have steel casing extending approximately 20 feet below surface. Water level stands approximately 8 - 10 ft. below the surface. The system has been in operation for over a year now and considerable amount of data on tidal tilts and their perturbations was obtained. Author (GRA)

N72-14411# Lamont-Doherty Geological Observatory, Palisades, N.Y.
HIGH GAIN, LONG PERIOD SEISMOGRAPH STATION INSTALLATION REPORT, FAIRBANKS, ALASKA
Andrew J. Murphy 31 Mar. 1971 66 p refs
(Contract F44620-70-C-0038; ARPA Order 1513)
(AD-729918; AFOSR-71-2370TR) Avail: NTIS CSCL 08/11

The report describes the installation of high-gain, long-period seismograph system at Fairbanks, Alaska. The station is located at 64 degrees 53 min. 58 sec. north latitude, 148 degrees 00 min. 20 sec. west longitude at an elevation of 330 m above sea level in a tunnel approximately 15 km from the World-Wide Standardized Seismic Network (WWSSN) station COL instrument vault. The system consists of three Geotech seismometers with natural periods of 30 sec (one vertical and two horizontal) each with two velocity transducers and one displacement transducer. Author (GRA)

N72-14412# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIURNAL VARIATIONS OF THE ELECTRON DENSITY FLUCTUATION IN THE IONOSPHERE OF THE NORTHERN HEMISPHERE
E. S. Kazimirovskii, V. D. Kokourov, and L. B. Napushina 26 Jul. 1971 17 p refs Transl. into ENGLISH from Ionosfernye Issled., Sb. Statei (Moscow), no. 15, 1968 p 77-84
(AF Proj. M122)
(AD-729950; FTD-HC-23-367-71) Avail: NTIS CSCL 04/1

The paper makes an attempt to connect the appearance of the so-called F-scatter with large-scale fluctuations of the electron density in the F region of the ionosphere. The analysis of data obtained at several ionospheric stations made it possible to construct for the Northern Hemisphere a 'map' of global variations of the P-index, which is proportional to the fluctuations of the electron density. Characteristic zones of fluctuations for magnetically quiet and magnetically disturbed days are revealed. Author (GRA)

N72-14413# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INVESTIGATION OF SCATTERED REFLECTIONS AT MAGNETIC CONJUGATE POINTS
E. S. Kazimirovskii and V. D. Kokourov 27 Jul. 1971 15 p refs Transl. into ENGLISH from the monograph "Issledovanie Ionosfery" Novosibirsk, 1970 p 131-139
(AF Proj. M122)
(AD-729949; FTD-HC-23-371-71) Avail: NTIS CSCL 04/1

A short survey of theories relating the dynamics of the magnetosphere with the formation of an inhomogeneous electron density in the ionospheric F region is given. Attention is given to diurnal variations in the frequency of occurrence and the intensity of F-layer scattering in magnetically conjugate points. Emphasis is placed on the latitudinal behavior of the phenomenon. The variations in the parameters characterizing the irregular ionospheric structure are shown to be related in magnetically conjugate points at low geomagnetic latitudes; no evident relation exists at higher latitudes. Author (GRA)

N72-14414# SACLANT ASW Research Center, la Spezia (Italy).
A SUMMARY OF OCEANOGRAPHIC DATA OBTAINED IN DEEP WATER IN THE STRAIT OF SICILY IN MAY 1970 (MILOCMED SURV 70)
David H. Shonting and Elvio Nacini 15 Jul. 1971 34 p refs
(AD-729837; SACLANTCEN-TM-168) Avail: NTIS CSCL 08/10

Observations of temperature and salinity using a TSD profiling system were made down to 500 m in a deep water area southeast of Pantelleria Island in the Strait of Sicily in May, 1970. The usual two layer system was observed, consisting of upper Atlantic water flowing ESE over a WNW flow of high-salinity eastern Mediterranean intermediate water. The variability observed in both the space and time stations occurred mainly in the upper 180 m layer, where the strongest temperature and salinity gradients occur. At a 12-hour time-station less variability in the profiles of temperature was observed than appeared at either of two 45-km long six-station spatial sections made 6 days apart in the same area. Author (GRA)

N72-14415# Lamont Geological Observatory, Palisades, N.Y.
HIGH-GAIN, LONG-PERIOD SEISMOGRAPH STATION INSTRUMENTATION, VOLUME 1
Lynn Sykes 31 Mar. 1971 383 p refs
(Contract F44620-70-C-0038; ARPA Order 1513)
(AD-729902; AFOSR-71-2372TR-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 08/11

Five high-gain, long-period seismograph stations are being installed, operated, and evaluated at sites in Alaska, Australia, Israel, Spain, and Thailand. Details of these installations are given in a series of five Technical Reports each entitled 'High-Gain, Long Period Seismograph Systems Installation Report.' These instruments are capable of operating at magnifications greater than 500,000 at periods of 35 to 45 seconds. The purpose of this report is to describe the instruments in detail, present a parts list, and present technical drawings and operation manuals for the major components. Author (GRA)

N72-14416# Lamont Geological Observatory, Palisades, N.Y.
HIGH-GAIN, LONG-PERIOD SEISMOGRAPH STATION INSTRUMENTATION, VOLUME 2
Lynn Sykes 31 Mar. 1971 214 p refs
(Contract F44620-70-C-0038; ARPA Order 1513)
(AD-729903; AFOSR-71-2373TR-Vol-2) Avail: NTIS CSCL 08/11

For abstract, see N72-14415

N72-14417# Naval Underwater Systems Center, Newport, R.I.
ESTIMATING OCEAN WIND WAVE SPECTRA BY MEANS OF UNDERWATER SOUND Ph.D. Thesis - N.Y. Univ.
Robert G. Williams 15 Jun. 1971 210 p refs
(NUSC Proj. A-400-05-00; NUSC Proj. A-072-0-0-00)
(AD-730709; NUSC-4097; Task-SF-11-522-101-12858; Task-ZR-011-01-01-61101N) Avail: NTIS CSCL 08/3

Measurements of the spectrum of ocean surface reradiated acoustic signals generated by an omnidirectional, sinusoidal source are used to estimate the ocean surface wave-height spectrum. Plane-wave physical optics theory is applied to a long-crested sea surface model to verify Marsh's hypothesis that, for low sea states, the spectrum of acoustic waves reradiated by the rough moving sea surface consists of a specular component at the transmitted frequency and a scattered component which is the weighted surface wave-height spectrum. The approach employs theories by Parkins, Clay and Medwin, and Pierson. The weighting function applied to the surface spectrum depends on signal frequency, experimental geometry, and mean-square wave height. CW signals at 127 Hz and 1702 Hz were transmitted from fixed, omnidirectional sources to receivers 4.5 km and 41 km downrange. Additionally, wave height was monitored continuously by resistance wave staff. The time series records of sound pressure level and ocean wave height were analyzed for spectral content. Agreement between theory and experiment is good when the acoustic sideband levels are not more than 25 dB below the peak level of the specular component. Author (GRA)

N72-14418# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELATIONSHIP BETWEEN ELECTRON CONCENTRATION AT ALTITUDES OF 100 AND 110 kM AND PERTURBATION OF THE EARTH'S MAGNETIC FIELD

L. P. Korsunova, V. M. Mishin, G. S. Ivanov-Kholbonyi, and T. V. Kazachevskaya 15 Jul. 1971 15 p refs Transl. into ENGLISH of the book Izd. Vo Nauka, Novosibirsk (USSR), 1970 p147-155

(Contract F33657-71-D-0057; AF Proj. M122)
(AD-730366; FTD-HC-23-369-71) Avail: NTIS CSCL 04/1

Analysis of the changes in the electron concentration in the lower E region of the ionosphere, and their association with geomagnetic field disturbances. It is shown that the daytime electron concentration increases roughly two times at 100 km and 1.5 times at 110 km at mid-latitudes for K equals 3 to 5 (where K is the 3 hour index whose changes characterize in the first approximation the variations of the geomagnetic field). The intensity of the flux of the additional ionizing radiation responsible for the observed increase in electron concentration is evaluated.
Author (GRA)

N72-14419# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF ATOMIC EXPLOSIONS ON THE IONOSPHERE
N. P. Benkova and N. I. Potapova 5 Aug. 1971 12 p refs Transl. into ENGLISH from the publ. "Doklady Nauchnogo Simpoziuma po Ionosfere. Rostov-Na-Donu, 21-22 April 1960" USSR Izd-vo Rostovskogo Univ., 1961 p 127-132 Presented at Sci. Symp. on the Ionosphere, Rostov-Na-Donu, USSR, 21-22 Apr. 1960
(AD-730368; FTD-MT-24-114-71; DIA-Task-T70-01-03; DIA-Task-T70-02-01D) Avail: NTIS CSCL 18/3

Results taken from the World Data Center were used to investigate ionospheric disturbances of non-solar origin during the 1958 nuclear tests over the Pacific and Atlantic Oceans. It was found that the explosion set off on August 1, 1958, had an appreciable effect on the ionosphere. It gave rise to an increase in the absorption in the lower ionosphere, a reduction in the ionization in the F layer, and a considerable variation in its height. Ionospheric effects were detected at distances up to about 6000 km from the epicenter. The effects of the explosion of August 12, 1958, were investigated in a similar way. At a distance of 1500 km from the epicenter there was a considerable increase in the absorption by the F2 layer 6 hours after the explosion. An initial reduction in the effective height of the F layer was followed by a rise above the normal level. At 4500 km there was also an initial reduction and a final rise in the effective height. At 6200 km, there was a tendency to a wave-like change in the effective height. At 7200 km the effective height increased up to 350 km, but no effects were observed in the critical frequencies.
Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-14420*# Barnes and Reinecke, Inc., Chicago, Ill.
DEVELOPMENT OF A WIDEBAND WATTMETER AS A LABORATORY INSTRUMENT
L. Gene Landes and Yen Yeh Liu Sep. 1971 45 p refs
(Contract NAS12-2181)
(NASA-CR-72752) Avail: NTIS CSCL 14B

A portable, solid state, wideband wattmeter has been developed as a general purpose type of laboratory instrument. Its circuit and component investigations and evaluation data are presented. A prototype unit was used extensively, and served as the basis for a second instrument incorporating refined circuitry and improved packaging. The wattmeter provides true four quadrant operation which permits instantaneous indication of real power as an oscilloscope display. Major performance factors are: frequency bandwidth DC to 1 MHz plus or minus 1 db; current range 10 mA to 100 amperes peak; voltage range 1 volt to 1000 volts peak; accuracy plus or minus 2% of full scale reading. Oscilloscope data for typical switching transients in a transistor inverter circuit are included.
Author

N72-14421*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LUNAR SURFACE CLOSEUP STEREOSCOPIC PHOTOGRAPHY ON THE OCEAN OF STORMS (APOLLO 12 LANDING SITE)
Grant H. Heiken and W. David Carrier, III Dec. 1971 40 p refs
(NASA-TM-X-58078) Avail: NTIS CSCL 14E

To obtain information about in-place lunar rocks and soil, a closeup stereoscopic camera capable of photographing small scale surface features was used at the Apollo 12 landing site on the Ocean of Storms. Fifteen stereoscopic photograph pairs were obtained. The stereoscopic pairs were of excellent quality and showed the in-place lunar material in detail. The photographs were analyzed and the results compared with the results of the Apollo 12 core sample analysis and other investigations. Significant information about the physical composition and genesis of the lunar soil at the Apollo 12 landing site was obtained. The cohesive soil on the Ocean of Storms probably results from repetitive bombardment of basalt flows by meteorites over long periods of time.
Author

N72-14422*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND TESTING OF THE INFRARED INTERFEROMETER SPECTROMETER FOR THE MARINER MARS 1971 SPACECRAFT
R. H. Hanel, B. Schlachman (NASA. Goddard Space Flight Center, Greenbelt, Md.), D. Vanous, D. Rogers (Texas Instr., Inc.), and J. H. Taylor, (comps.) (JPL) 1 Dec. 1971 34 p refs
(Contract NAS7-100)
(NASA-CR-124743; JPL-TM-33-509) Avail: NTIS CSCL 14B

The design, development and testing of the infrared interferometer spectrometer is reported with emphasis on the unique features of the Mariner instrument as compared to previous IRIS instruments flown on the Nimbus meteorological research satellites. The interferometer functions in the spectral range from 50 microns to 6.3 microns. A noise equivalent radiance of 0.5 X 10 to the -7th power W/sq cm/ster/cm has been achieved. Major improvements that were implemented included the cesium iodide beamsplitter and electronic features to suppress the effect of vibration on the Michelson mirror motion and digital filtering through the summation of increased sampling of the infrared signal. A bit error detection and correction scheme was also implemented in order to recover the science data with a higher level of confidence over the telecommunication link.
Author

N72-14423*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IMP-H ION COMPOSITION EXPERIMENT
M. H. Acuna and K. W. Ogilvie Sep. 1971 32 p refs
(NASA-TM-X-65778; X-692-71-385) Avail: NTIS CSCL 14B

A compact mass energy spectrometer to be flown aboard the IMP-H spacecraft is described. Scientific aims include determination of the relative and absolute fluxes of He-4(2+), He-4 (+), O(6+), and O(7+), and He-3(2+).
Author

N72-14424# McMaster Univ., Hamilton (Ontario). Centre for Applied Research and Engineering Design.
EARTH RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING Final Report
J. MacDowall and B. H. Nodwell 31 May 1971 180 p refs
(CARED Proj. 156)
Avail: NTIS

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A survey of earth resource sensors which were available or under development was conducted to compile a comprehensive compendium of all the significant physical characteristics of remote sensors, together with some sketches illustrating their method of operation. For example, in the case of spectrometers, a table is included giving a numerical measure of twenty-three physical attributes, including size, weight and cost. This information is helpful in selecting the most appropriate available system for use, and will also help guide sensor development into those areas not covered by existing systems. The tables are arranged in such a way that comparison of characteristics between sensors is easily made. A brief introduction to each class of sensors is given, together with a brief description of each system. The discussions give an introduction to the physical basis of each sensor and facilitate comparisons with other systems. For each of the major types of systems, a detailed questionnaire was drawn up and then sent to sensor manufactures and developers. Author

N72-14425*# University of South Florida, Tampa.
CONFERENCE ON PHOTOGRAPHIC ASTROMETRIC TECHNIQUE Dept. of Astronomy.
Heinrich Eichhorn, (ed.), and George D Gatewood Washington NASA Nov. 1971 273 p refs Presented at Tampa, Fla., 18-20 Feb. 1968
(Contract NSR-10-008-013)
(NASA-CR-1825) Avail: NTIS CSCL 03A

Techniques for obtaining astrometric photointerpretations of stellar photographs, as well as their mensuration and reduction are discussed in this conference. Applications of photographic astrometrics in satellite geodesy and astronomical catalog documentation are stressed. For individual titles, see N72-14426 through N72-14452.

N72-14426*# Minnesota Univ., Minneapolis.
THE ORIGIN AND GOALS OF THE AUTOMATED STELLAR PROPER MOTION SURVEY c30
Willem J. Luyten *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 1-3 (See N72-14425 05-14)
Avail: NTIS CSCL 03A

The historical background of the automation of the stellar proper motion survey is traced from its beginnings to the taking of the series of plates with the 48 inch Schmidt telescope at Mount Palomar covering 77% of the sky with 936 plates. The design goal for the automation is the documentation of the proper motions of stars from tenth through twentieth red magnitude. A typical scanning time for a pair of 14 inch star plates is projected to be about 45 minutes with the total processing time estimated at between one and two years for the complete set of plates. Author

N72-14427*# Control Data Corp., Minneapolis, Minn.
THE AUTOMATION OF THE STELLAR PROPER MOTION SURVEY c30
James. S. Newcomb *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 3-14 refs (See N72-14425 05-14)
(Contract NSR-24-005-062)
Avail: NTIS CSCL 03A

A microdensitometer, scanning pairs of star plates of identical areas of the sky taken a decade apart, is coupled to a magnetic tape unit through a data acquisition system. This system performs an image density threshold level selection for each plate and a buffer memory system to smooth the data flow as well as analog and digital display controls. The data from the tape are processed later by a large scale high speed computer which reconstructs the scanned images, discovers, measures, and documents stellar proper motions by precise comparison of corresponding areas of the two star plates to detect those images which have moved at least 0.10 seconds annually in the time interval between the exposures. Author

N72-14428*# Brookhaven National Lab., Upton, N.Y.
COMPUTER CONTROLLED PRECISION DIGITIZERS OF OPTICAL IMAGE DATA EXTRACTION
Richard C. Strand *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 15-24 refs Sponsored in part by AEC (See N72-14425 05-14)
Avail: NTIS CSCL 14E

The flying spot digitizer and its applications are described. Suggestions are made as to how this apparatus might be used for the precise and fast measurement of star images on photographic plates. Author

N72-14429*# University of South Florida, Tampa.
THE USEFULNESS OF A FLYING SPOT DIGITIZER FOR THE MEASUREMENT OF THE COORDINATES OF STAR IMAGES ON PHOTOGRAPHIC PLATES Final Report
Heinrich Eichhorn and George D. Gatewood *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 25-32 refs (See N72-14425 05-14)
(Grant NGR-10-008-011)
Avail: NTIS CSCL 14B

The flying spot digitizer can measure the coordinates of star images on photographic plates in one pass with an accuracy of 4.8 microns r.m.s. error. A field of the size 50 x 100 square millimeters is measured in a few seconds. Suggestions are made as to how a better accuracy can be achieved through the way in which the measurements are arranged and by repetition of the measurements. It is suggested that the speed of photographic astrometric measurements can be improved by about two orders of magnitude, at no loss of accuracy, by proper use of the FSD. Author

N72-14430*# Lick Observatory, Mount Hamilton, Calif.
THE LICK-GAERTNER AUTOMATIC MEASURING SYSTEM
S. Vasilevskis and W. A. Popov (Gaertner Scientific Corp.) *In* Univ. of South Fla. Conf. on Photo. Astrometric Technique Nov. 1971 p 33-48 refs Sponsored in part by NSF (See N72-14425 05-14)
Avail: NTIS CSCL 14B

The Lick-Gaertner automatic equipment has been designed mainly for the measurement of stellar proper motions with reference to galaxies, and consists of two main components: the survey machine and the automatic measuring engine. The survey machine is used for initial inspection and selection of objects for subsequent measurement. Two plates, up to 17 x 17 inches each, are surveyed simultaneously by means of projection on a screen. The approximate positions of objects selected are measured by two optical screws: helical lines cut through an aluminum coating on glass cylinders. These approximate coordinates to a precision of the order of 0.03mm are transmitted to a card punch by encoders connected with the cylinders. Author

N72-14431*# Naval Observatory, Washington, D.C.
A SEMI-AUTOMATIC MEASURING MACHINE
K. Strand *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 49-54 (See N72-14425 05-14)
Avail: NTIS CSCL 14B

A machine designed to locate automatically a star image on a photographic plate from approximate coordinates on a punched card and to measure and record its position to a micron is described. The main frame of the machine is of granite, as are the x and y coordinate carriages which move on air bearings against granite ways. The system is capable of making measurements continuously over a 10 x 10 inch range by means of a Ferranti moire fringe system, with a least count of one micron. Author

N72-14432*# University of South Florida, Tampa.
THE EXTRACTION OF ACCURATE COORDINATES OF IMAGES ON PHOTOGRAPHIC PLATES BY MEANS OF A SCANNING TYPE MEASURING MACHINE

B. E. Ross *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 55-60 refs (See N72-14425 05-14)
Avail: NTIS CSCL 14E

The Moire method experimental stress analysis is similar to a problem encountered in astrometry. It is necessary to extract accurate coordinates from images on photographic plates. The solution to the mutual problem found applicable to the field of experimental stress analysis is presented to outline the measurement problem. A discussion of the photo-reading device developed to make the measurements follows. Author

N72-14433*# Harvard Coll. Observatory, Cambridge, Mass.
IMPROVEMENTS IN ROSS TYPE ASTROMETRIC OBJECTIVES
James E. Baker *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 61-84 refs (See N72-14425 05-14)
Avail: NTIS CSCL 14E

It is shown that aspheric deformations of the first and fourth elements of the four element Ross objective can be introduced to permit one to obtain improved color corrections for astrometric purposes. The usual monochromatic aberrations are as well corrected as for the standard Ross lens. In addition, one can eliminate or reduce additional aberrations, such as secondary spectrum, chromatic spherical aberration, chromatic coma and chromatic distortion. The resulting objectives are suitable for use as intermediate and long focus astrometric objectives covering large angle fields. Author

N72-14434*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
COMPARISON OF PHOTOGRAMMETRIC AND ASTROMETRIC DATA REDUCTION RESULTS FOR THE WILD BC-4 CAMERA
D. H. Hornbarger and Ivan Mueller, I. *In* Univ. of South Fla. Conf. on Photo. Astrometric Technique Nov. 1971 p 85-98 refs (See N72-14425 05-14)
(Grant NGR-36-008-093)
Avail: NTIS CSCL 14E

The results of astrometric and photogrammetric plate reduction techniques for a short focal length camera are compared. Several astrometric models are tested on entire and limited plate areas to analyze their ability to remove systematic errors from interpolated satellite directions using a rigorous photogrammetric reduction as a standard. Residual plots are employed to graphically illustrate the analysis. Conclusions are made as to what conditions will permit the astrometric reduction to achieve comparable accuracies to those of photogrammetric reduction when applied for short focal length ballistic cameras. Author

N72-14435*# Universitaets-Sternwarte, Vienna (Austria).
ASTROMETRIC INVESTIGATIONS AT THE VIENNA OBSERVATORY AND ASTROMETRIC PLANS FOR THE 60 INCH REFLECTOR OF THE L. FIGL OBSERVATORY
Joseph Meurers *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 99-108 refs (See N72-14425 05-14)
Avail: NTIS CSCL 14B

A short discussion of the astrometric instruments at the Vienna Observatory is given. The essential features of design and organization of the planned 60 inch telescope are described. Furthermore, several points of view concerning modern astrometry are discussed, especially the usefulness of comparing astrometric results based upon different instruments, for instance the comparison between mirrors and refractor based data. Some examples are given together with new immediate results. Lastly, as far as possible at this moment astrometric plans for the new telescope are formulated. Author

N72-14436*# Aeronautical Chart and Information Center, St. Louis, Mo.
AUTOMATIC PLATE MENSURATION AND REDUCTION AT AERONAUTICAL CHART AND INFORMATION CENTER
Thomas O. Seppelin *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 109-118 (See N72-14425 05-14)
Avail: NTIS CSCL 14E

The use of optical satellite observation data for geodetic purposes depends on the ability to extract pertinent information from photographic plates by identifying points on the plates and correlating them with known star positions for use in geodetic positioning. This procedure is accomplished with a new semi-automatic measuring system, an advanced analytical plate reduction program for the IBM 7094 computer, and a triangulation adjustment. The advantages gained with the measuring system, a brief discussion of the system itself, and the plate reduction and triangulation adjustment are described. Author

N72-14437*# New Mexico State Univ., University Park.
THE REDUCTION OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PLATES AT THE NEW MEXICO UNIVERSITY
Walter H. Haas *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 119-122 (See N72-14425 05-14)
Avail: NTIS CSCL 14E

A method of reducing GEOS satellite plates is described. The catalog positions of stars, whose images were measured, are updated to the time of the photographic observation. The plate constants are used to compute the positions of the seven (or fewer) flashing light images which were measured. These are corrected for refraction, parallax, and radial and decentering lens distortions. With sidereally tracking cameras, the exterior orientation is further corrected to the time of the particular flash, and the change of refraction with time is allowed for. First and second differences and standard deviations and covariances for the flashing light images are developed as a measure of accuracy. Author

N72-14438*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
COMMENTS ON THE ACCURACY OF BAKER-NUNN OBSERVATIONS
Kurt Lambeck *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 123-132 (See N72-14425 05-14)
(Grant NGR-09-015-002)
Avail: NTIS CSCL 14E

Many factors influence the accuracy with which the satellite positions may be derived from Baker-Nunn observations. Some of these factors are more important than others. In an accuracy study of satellite tracking methods there are invariably two distinct aspects to be investigated: the accuracy with which the satellite position can be referred to the reference system used - the stellar framework in the case of the optical observations, and the accuracy of the instant of observation. It is generally desirable to keep time as an independent variable so that any uncertainty in measuring the time of observation will be reflected in the positional accuracy. Author

N72-14439*# Environmental Science Services Administration, Washington, D.C.
OBSERVATIONS AND REDUCTION TECHNIQUES OF THE US COAST AND GEODETIC SURVEY
Hellmut H. Schmid *In* Univ. of South Fla. Conf. on Photo. Astrometric Technique Nov. 1971 p 133-140 refs (See N72-14425 05-14)
Avail: NTIS CSCL 14E

The plate reduction method and other aspects of the world geodetic net are described. About one hundred stars are used as reference stars on the PAGEOS satellite plates obtained on 300mm f.1. and later 450mm f.1. Wild BC-4 cameras. The measurements are made manually now on diapositives since these can, according to experience, be measured with higher accuracy and are adjusted following a rigorous projective

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geometric model. The satellite images are analytically represented by a polynomial curve, of which seven fictitious points are regarded as the result from this plate. Some other aspects of the program are also discussed. Author

N72-14440*# Royal Radar Establishment, Malvern (England).
AN f1 SCHMIDT SATELLITE CAMERA AND THE METHODS OF PLATE MEASUREMENT AND REDUCTION
J. Hewitt *In* Univ. of South Fla. Conf. on Photo. Astrometric Technique Nov. 1971 p 141-154 refs (See N72-14425 05-14)
Avail: NTIS CSCL 14E

The f1 Hewitt camera is a field flattened Schmidt system of 60cm aperture. The salient features of this equipment are briefly described. Details of the methods of plate measurement are then given. The plate reduction is carried out in two stages. The plate is first calibrated using the photogrammetric method. The formulae usually quoted have been extended to take account of the large distortion introduced by the field flattening lens. In the second stage, the satellite measurements are reduced to satellite positions corrected for refraction, aberration, and when necessary, phase. Author

N72-14441*# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
PLATE MEASUREMENT TECHNIQUES AND REDUCTION METHODS USED BY THE WEST GERMAN SATELLITE OBSERVERS, AND RESULTING CONSEQUENCES FOR THE OBSERVATION
Hermann Deker *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 155-160 ref (See N72-14425 05-14)
Avail: NTIS CSCL 14E

The West German tracking stations are equipped with ballistic cameras. Plate measurement and plate reduction must therefore follow photogrammetric methods. Approximately 100 star positions and 200 satellite positions are measured on each plate. The mathematical model for spatial rotation of the bundle of rays is extended by including terms for distortion and internal orientation of the camera as well as by providing terms for refraction which are computed for the measured coordinates of the star positions on the plate. From the measuring accuracy of the plate coordinates it follows that the timing accuracy for the exposures has to be about one millisecond, in order to obtain a homogeneous system. Author

N72-14442*# Hamburger Sternwarte (West Germany).
THE AGK3, A BASIS FOR A GENERAL (NORTHERN) REFERENCE CATALOGUE OF POSITIONS AND PROPER MOTIONS **c30**
Wilhelm Dieckvoss *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 161-168 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

The original concept of the international AGK3 program is presented and a report on the methods applied and on the progress of the work is given. The results in the form of revised positions of the AGK2 reduced to the FK4 system, and of AGK3, can be extrapolated easily to earlier epochs, as far back as those of AGK1, and the mean error for these epochs will permit one the deriving of reliable values for systematic corrections of the old catalogs. By using the AGK2/3 positions a general catalog of roughly to the ninth magnitude can be constructed by including large catalogs such as AGK1, AC, and Yale. Thus a new edition of the type of the SAO catalog for the northern hemisphere can be produced. Author

N72-14443*# University of South Florida, Tampa.
AN ANALYSIS OF THE AGK3 COMPARISON STAR POSITIONS **c30**
Paul Herget (Cincinnati Obs.) *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 169-172 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

Proper motions formed with the use of positions in the AGK3 and other, older catalogues are investigated for systematic trends. Author

N72-14444*# Yale Univ. Observatory, New Haven, Conn.
RECENT PROGRESS ON THE YALE ZONE CATALOGUES **c30**
Dorrit Hoffleit *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 173-180 refs Sponsored by Army Map Service (See N72-14425 05-14)
Avail: NTIS CSCL 03A

The measurement or reduction of stars in southern zones is reported. The catalog for the -35 deg to -40 deg zone is rapidly nearing completion. All the reductions and comparisons with other catalogs have been completed. The tables and star charts are being prepared in final form for publication. Author

N72-14445*# Naval Observatory, Washington, D.C.
COMPARISON OF THE SAO AND AGK3R STAR CATALOGUES **c30**
F. P. Scott and C. A. Smith, Jr. *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 181-190 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

The SAO star catalog positions from the GC and the AGK2 and Yale photographic catalogs are compared with the AGK3R catalog. Both catalogs are alleged to be on the system of the FK4. When the differences are considered as accidental errors, the mean errors deduced for positions from the SAO at the epoch 1958.5 range from 0.61 seconds to 0.25 seconds. The systematic differences in right ascension between SAO and AGK3R positions to the north of 60 deg declination indicate that each SAO source represents the FK4 somewhat differently than the AGK3R. Author

N72-14446*# University of South Florida, Tampa.
PLANS FOR A STANDARD REGION FOR LONG FOCUS ASTROGRAPHS **c30**
George D. Gatewood and Laurence W. Fredrick (Leander McCormick Obs.) *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 191-196 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

The construction of a catalog of precise star positions in the region of Praesepe is proposed. A list of the 408 stars to be included is given. The program stars were chosen on the basis of their position, magnitude and color, and the availability of accurate early epoch positions. The present status of the project is noted. Author

N72-14447*# Royal Observatory, Cape Town (South Africa).
CAPE PHOTOGRAPHIC CATALOGUES **c30**
R. H. Stoy *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 197-199 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

A history and discussion of the photographic star catalog work at the Cape Observatory is given. Author

N72-14448*# Royal Observatory, Cape Town (South Africa)
THE IMPROVEMENT OF STAR POSITIONS BY PHOTOGRAPHIC METHODS
S. V. M. Clube *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 199-208 refs (See N72-14425 05-14)
Avail: NTIS CSCL 14E

A brief description is given of the new astrometric camera and of the program on which it is being employed. This is the photography of the southern sky so that each star appears on at least four overlapping plates. Sets of star coordinates measured

on each plate are combined with a limited set of provisional meridian places to give an accurate set of relative star positions which are independent of the meridian system together with a set of residuals for each plate-star. The technique is based on a simple geometrical model of image formation on photographic plates. Current investigations are concerned with the elimination of sources of systematic deviation from this model. Author

N72-14449*# Army Topographic Command, Washington, D.C.
PHOTOGRAPHIC ASTROMETRY AND OVERLAP REDUCTION TECHNIQUES
William D. Googe and Carl F. Lukac *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 209-218 refs (See N72-14425 05-14)
Avail: NTIS CSCL 14E

Rigorous adjustment algorithms are discussed which extract hidden information contained in overlapping photographs of star fields. In particular, the development of adequate physical and statistical models is emphasized. Author

N72-14450*# University of South Florida, Tampa.
THE OVERLAP METHODS
Pierre Lacroute (Obs. of Strasbourg) *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 219-240 refs (See N72-14425 05-14)
Avail: NTIS CSCL 14E

The different methods of reducing measurements on photographic plates by the overlap methods are compared. An attempt is made to distinguish the methods accepted by most astronomers from those not generally agreed upon and from those that are still being studied. Questions examined are: organization of future works, improvement of AGK2 and AGK3, and solutions for the astrographic catalog, as well as considerations of some empirical methods. Author

N72-14451*# University of South Florida, Tampa.
THE BEHAVIOR OF MAGNITUDE DEPENDENT SYSTEMATIC ERRORS **c30**
Heinrich Eichhorn *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 241-248 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

The objective grating technique is discussed. From the investigation of actual material, it is established that the effect of coma varies significantly from plate to plate, also that a model linear in diameter and/or coordinate may be inadequate for its removal, and even introduce systematic errors. From this standpoint, the requirements of reference star systems are discussed. Author

N72-14452*# DBA Systems, Inc., Melbourne, Fla.
INVERSION OF VERY LARGE MATRICES ENCOUNTERED IN LARGE SCALE PROBLEMS OF PHOTOGRAMMETRY AND PHOTOGRAPHIC ASTROMETRY **c30**
Duane C. Brown *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 249-267 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

The simultaneous adjustment of very large nets of overlapping plates covering the celestial sphere becomes computationally feasible by virtue of a twofold process that generates a system of normal equations having a bordered-banded coefficient matrix, and solves such a system in a highly efficient manner. Numerical results suggest that when a well constructed spherical net is subjected to a rigorous, simultaneous adjustment, the exercise of independently established control points is neither required for determinancy nor for production of accurate results. Author

N72-14453*# National Aeronautics and Space Administration, Washington, D.C.
TESTING METHODS AND TECHNIQUES: ENVIRONMENTAL TESTING: A COMPILATION **Technology Utilization**
[1971] 25 p refs
(NASA-SP-5945(01)) Avail: NTIS; HC $1.00/MF $0.95
CSCL 14B

Various devices and techniques are described for testing hardware and components in four special environments: low temperature, high temperature, high pressure, and vibration. Items ranging from an automatic calibrator for pressure transducers to a fixture for testing the susceptibility of materials to ignition by electric spark are included. Author

N72-14454*# Bellcomm, Inc., Washington, D.C.
FIRST EARTHSHINE PHOTOGRAPHY FROM LUNAR ORBIT
D. D. Lloyd 15 Dec. 1971 20 p refs
(Contract NASw-417)
(NASA-CR-124752; TM-71-2015-10; Case-340) Avail: NTIS CSCL 14E

During Apollo 15, fifteen photographs of the moon were taken under Earthshine illumination. These were the first Earthshine photographs taken from lunar orbit. The photographs are of photometric interest, particularly as they involve double reflection of sunlight: by the earth, then the moon, prior to photographic exposure. Certain published data on the mean illumination of the moon by the crescent earth predicted lower exposure values than obtained for each measured area. The apparent albedo values obtained for the floor of the crater Aristarchus were anomalously higher than those obtained for the surrounding maria. Author

N72-14455*# Bellcomm, Inc., Washington, D.C.
LUNAR ORBITAL PHOTOGAPHIC PLANNING CHARTS FOR CANDIDATE APOLLO J-MISSIONS
P. J. Hickson and W. L. Piotrowski 29 Oct. 1971 53 p
(Contract NASw-417)
(NASA-CR-124756; TM-71-2015-6; Case-340) Avail: NTIS CSCL 14E

A technique is presented for minimizing Mapping Camera film usage by reducing redundant coverage while meeting the desired sidelap of greater than or equal to 55%. The technique uses the normal groundtrack separation determined as a function of the number of revolutions between the respective tracks, of the initial and final nodal azimuths (or orbital inclination), and of the lunar latitude. The technique is also applicable for planning Panoramic Camera photography such that photographic contiguity is attained but redundant coverage is minimized. Graphs are included for planning mapping camera (MC) and panoramic camera (PC) photographic passes for a specific mission (i.e., specific groundtracks) to Descartes (Apollo 16), for specific missions to potential Apollo 17 sites such as Alphonsus, Proclus, Gassendi, Davy, and Tycho, and for a potential Apollo orbit-only mission with a nodal azimuth of 85 deg. Graphs are also included for determining the maximum number of revolutions which can elapse between successive MC and PC passes, for greater than or equal 55% sidelap and rectified contiguity respectivey, for nodal azimuths between 5 deg and 85 deg.
Author

N72-14456*# Techtran Corp., Glen Burnie, Md.
CONTRIBUTIONS TO THE THEORY OF THE MICROSCOPE AND MICROSCOPIC OBSERVATIONS
E. Abbe Washington NASA Mar. 1971 53 p Transl. into ENGLISH from Arch. Mikrosk. Anat. (Leipzig), v. 9, 1873 p 413-468
(Contract NASw-2037)
(NASA-TT-F-13840) Avail: NTIS CSCL 20F

Microscope design has largely been a matter of empirical testing which served as the basis of theory. Dioptric considerations have involved such factors as chromatic and spherical aberrations, as well as image brightness. Physical conditions for the imaging of fine detail are defined in terms of the wave theory of light. The optical capacity of a microscope depends on the size of the circle of confusion in the image plane as well as the ability of the microscope physically to resolve the desired detail. Nothing can be seen with any microscope, which cannot be resolved by the human eye with 800X immersion magnification. Author

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N72-14457*# Battelle Memorial Inst., Columbus, Ohio.
NONCONTACTING MEASURING DEVICE TO INDICATE DEFLECTION OF TURBOPUMP INTERNAL ROTATING PARTS Quarterly Report, 1 Jun. - 31 Aug. 1971
D. B. Hamilton, D. R. Grieser, A. M. Plummer, Dale Ensminger, E. J. Saccocio, and J. W. Kissel 20 Sep. 1971 33 p
(Contract NAS8-26903)
(NASA-CR-121060; QR-2) Avail: NTIS CSCL 14B

Noncontacting, nondestructive techniques to measure vibrations and deflections of parts in future LOX and LH2 multistage turbopump prototypes are reported. The measurements include shaft vibration, vibration of turbine wheel and blades, blade clearance, vibration of impellers, value component flutter, and vibration of face seal components. Three techniques were selected for development: ultrasonic Doppler devices, flash X-ray, and light-pipe reflectance. Author

N72-14458# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.
THE EFFECT OF CONE ANGLE ON PENETRATION RESISTANCE
Edward A. Nowatzki and L. L. Karafiath Jan. 1972 28 p refs Presented at Ann. Meeting of Highway Res. Board, Washington, D. C., 17-21 Jan. 1972
(RM-532J) Avail: NTIS

Cone penetrometers offer a relatively quick and simple method of measuring soil strength properties in situ. A theoretical analysis, based on the numerical solution of the differential equations of plasticity, is presented, which takes into account both axial symmetry and friction at the surface of the cone. The resistance of penetrometers having various cone apex angles was determined by this method for a range of soil properties. The computed cone indices are compared with those measured in the laboratory. Conclusions are presented regarding the efficacy of the cone penetrometer in measuring soil strength, and recommendations are made to help resolve the ambiguities inherent in the cone index measurement. Author

N72-14459*# Kansas State Univ., Manhattan. Dept. of Physics.
INFRARED LABORATORY STUDIES OF SYNTHETIC PLANETARY ATMOSPHERES Semiannual Status Report, 1 Jun. - 30 Nov. 1971
Dudley Williams 15 Dec. 1971 79 p refs
(Grant NGR-17-001-026)
Avail: NTIS CSCL 14B

The broadening of individual lines in the CO fundamental by various gases has been investigated. The results indicate that the ratio of the self-broadening ability of CO to the line-broadening ability of foreign gases is greater for lines in the band wings than for lines near the band center when the molecular mass of the broadener is less than that of CO. The results have been interpreted in terms of a phenomenological theory. Studies of the relative line broadening abilities of foreign gases have provided information that can be used to provide optical collision cross sections for individual lines in the CO fundamental. Author

N72-14460*# Techtran Corp., Glen Burnie, Md.
EOLE BALLOON SENSORS
J. S. Boutemy Washington NASA Feb. 1971 14 p refs Transl. into ENGLISH of "Capteurs 'EOLE Balloons'", Centre Natl. Space d'Etudes Spatial, Bretigny, France, report 71/893/CT/TE/EG/EOLE/B
(Contract NASw-2037)
(NASA-TT-F-13849; Rept-71/893/CT/TE/EG/EOLE/B) Avail: NTIS CSCL 14B

Brief summaries are presented of the various tests performed at the prototype phase on pressure, overpressure, and temperature sensors in the EOLE capsule. Author

N72-14461# Aeronautical Research Labs., Melbourne (Australia).
A LINEAR DIFFERENTIAL PRESSURE TRANSDUCER INCORPORATING HIGH STABILITY VARIABLE FREQUENCY OSCILLATORS AND A CAPACITANCE SENSOR
N. J. Sullivan Apr. 1971 51 p refs
(ARL/ME-132) Avail: NTIS

A differential pressure transducer incorporating a capacitance sensing element and highly stable oscillators to provide a variable frequency output is described. Both the sensing element and the oscillator are examined from first principles with the primary considerations being accuracy, linearity and stability. The requirements for application of the transducer as an airspeed indicator with the output to be recorded on a magnetic tape recorder are considered. Experimental results for the complete transducer are presented and compared with the design specifications. Author

N72-14462# Aeronautical Research Labs., Melbourne (Australia).
AN IMPROVED DESIGN OF STRAIN GAUGE STING BALANCE FOR SMALL WIND TUNNEL MODELS
N. Pollock Jul. 1971 24 p refs
(ARL/A-Note-331) Avail: NTIS

A six-component strain gage sting balance for a wind tunnel model was designed and tested. The balance, which has a normal force capacity of 250 lb., incorporates a number of novel design features which result in reasonably high output and small interactions being obtained along with small size, high stiffness and ease of manufacture. Author

N72-14463# Royal Aircraft Establishment, Farnborough (England).
FACTORS WHICH DETERMINE THE SHAPE OF THE CHARACTERISTIC CURVE OF AN EMULSION IN TERMS OF THE EXPOSURE LIGHT
Maria Teresa Vigon and Maria Angeladelavega Jun. 1971 16 p refs Transl. into ENGLISH from Anales Real Soc. Espan. Fis. Quim., Ser. A (Madrid), v. 48, no. 7-8, 1952
(RAE-LIB-TRANS-1571) Avail: NTIS

Causes of variation in the form of the characteristic curve of a photographic emulsion were observed during modification of the spectral composition of the exposure light. Fundamental characteristics noted were the absorption of light by the emulsion, absorption by grains of silver halogen salts, and distribution of the latent image on the surface and interior of the grains. An approximate empirical relationship was established. Author

N72-14464*# National Aeronautics and Space Administration, Washington, D.C.
VACUUM RADIATION TEST OF THERMAL MOCK-UP OF INFRARED DETECTOR COOLING SYSTEM
F. Galzin Jan. 1971 41 p refs Transl. into ENGLISH of "Essai en Vide Rayonnement de la Maquette Thermique du Systeme de Refroidissement du Detecteur I.R.", Natl. Center for Space Res., Bretigny, France, report 70-CT.TA.TP/METEOSAT-0-492
(NASA-TT-F-13833; Rept70.CT.TA.TP/METEOSAT-0-492) Avail: NTIS CSCL 14B

Vacuum radiation tests in the METEOSAT program were carried out in a mock-up and demonstrated the feasibility of a passive thermal control for the infrared detector of the METEOSAT satellite in the case of reversal of the satellite. Description of a mock-up is provided. Test results are given in detail and compared with predicted results. Author

N72-14465*# Boeing Co., Seattle, Wash. Research and Engineering Div.
FABRICATION OF THE TITANIUM TRANSITION RING OF THE LARGE SPACE TELESCOPE (LST) Final Report
Leo A. Klein Dec. 1971 11 p
(Contract NAS5-11451)
(NASA-CR-122328) Avail: NTIS CSCL 14B

The fabrication of the titanium transition ring is summarized. The transition ring assembly was designed for the large space telescope and consists of two large titanium rings bolted together. The cross section dimensions of the assembly are

13-inches wide by 7-inches thick. The fabrication processes are discussed, and it is concluded that the work involved fabricating the largest titanium forging ever made. F.O.S.

N72-14466# Battelle-Northwest, Richland, Wash.
HANFORD THERMOLUMINESCENT MULTIPURPOSE DOSIMETER
L. F. Kocher, G. W. R. Endres, L. L. Nichols, D. B. Shipler, and A. J. Haverfield 28 May 1971 70 p refs Presented at the Workshop on Personnel Neutron Dosimetry, New York, 8 Jul. 1971
(Contract AT(45-1)-1830)
(BNWL-SA-3955; Conf-710714-1) Avail: NTIS

A five-element thermoluminescent dosimeter for beta particles, photons, and neutrons had been developed using LiF blocks. One Li-7F block is shielded to provide interpretation of the one centimeter tissue depth dose. A second Li7F block is unshielded to provide the derma dose interpretation. Two Li-6F and one Li-7F blocks are used for fast and thermal neutron dose interpretation. The accurate response of the dosimeter to the wide variety of radiation sources makes it a good replacement of the film badge for routine personnel dosimetry. Author (NSA)

N72-14467# Osservatorio Astrofisico di Arcetri, Florence (Italy).
PROJECT AND REALIZATION OF A RADIO SPECTRO-RADIOMETER FOR SOLAR ACTIVITY [PROGETTO E REALIZZAZIONE DI UN RADIOSPETTROMETRO PER ATTIVITA SOLARE]
P. Pampaloni and G. Tofani Florence Univ. 1970 25 p refs In ITALIAN Sponsored by SNAM
(Fasc-97) Avail: NTIS

A design of a spectroradiometer for radio frequency scanning the field, ranging from 50 to 1000 MHz with a window of 2 MHz is described. The instrument is designed for measurements of the radio solar bursts. Tests on an amplitude/frequency CRT representation, showed a very strong interference of the solar radio emission with the radio and TV broadcasts. ESRO

N72-14468# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
FREQUENCY MEASUREMENT USING LINEAR DISPERSION FILTER: A CONTRIBUTION TO THE PROBLEM OF FREQUENCY DETERMINATION OF SINUSOIDAL SIGNALS OF SHORT DURATION Ph.D. Thesis - Tech. Hochschule Aachen [FREQUENZMESSUNG MIT LINEAR DISPERSIVEM FILTER. EIN BEITRAG ZUM PROBLEM DER FREQUENZBESTIMMUNG KURZZEITIGER SINUSFOERMIGER SIGNALE]
Klaus Kruecker Jul. 1971 142 p refs In GERMAN Sponsored by Bundesmin. fuer Verteidigung
(Rept-2-71) Avail: NTIS

A method to determine the frequency of short duration sinusoidal signals in the presence of white, normally distributed, noise is theoretically and experimentally described. This problem occurs in position determination of moving targets, primary radar pulses, and frequency shift keying data transmission. The measurement technique proposed is based on pulse compression of linear frequency modulated signals, and makes technical use of the frequency-time coupling of input and output signal of a pulse compression filter. The realized method with linear dispersion filter and a suitable signal preprocessing has a frequency range between 10 MHz and 100 MHz, and can be simply adapted to the deviation of the analyzed signal. ESRO

N72-14469# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
STUDY OF DESIGN FOR IMPROVED ACCURACY OF INFRARED EARTH SENSORS Final Report
P. Conjeaud and C. Payen 10 Dec. 1970 154 p
(LCR-DR-1-70-100/1/R) Avail: NTIS

A design study for an infrared remote sensor using a thermistor bolometer is presented. The conventional V sensor method is used to minimize the influence of error signals on roll and pitch angle. This method utilizes one or two optical systems (North and South) associated with two photosensitive detectors attached to spinning parts to determine satellite position. Details are given of the choice of spectral band, the infrared detector, the optical system, and the electronic circuits. The influence of error on performance was calculated including noise errors, quantification errors, seasonal radiance variations, spin velocity variation, alignment errors, and time constant variations. ESRO

N72-14470# Army Foreign Science and Technology Center, Charlottesville, Va.
CODING THEODOLITE
V. G. Shults and E. Ya. Yankovskii 14 Jul. 1971 13 p Transl. into ENGLISH from Kodovyi Teodolit, Geod. Kartografiya (USSR), no. 3, 1971 p 42-46
(FSTC Proj. t7023012301)
(AD-728842; FSTC-HT-23-1284-71) Avail: NTIS CSCL 17/8

A coding theodolite prototype with photographic recording of measurement results for direct computer input was developed and tested. Author (GRA)

N72-14471# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF A MASS SPECTROMETER PROBE FOR DENSITY AND VELOCITY DISTRIBUTION MEASUREMENTS IN A ROCKET EXHAUST PLUME Final Report, 17 Oct. 1969 - 1 Jun. 1970
H. M. Powell, D. W. Hill, and D. L. Whitfield AEDC Sep. 1971 27 p refs
(Contract F40600-71-C-0002; ARO Proj. VW3008; ARO Proj. ST 1027)
(AD-729206; AEDC-TR-71-135; ARO-VKF-71-50) Avail: NTIS CSCL 14/2

The evaluation of a mass spectrometer probe in a highly expanded exhaust plume of a small rocket is described in this report. This probe, which utilizes a quadrupole mass spectrometer, is used for species identification and concentration measurements and for velocity distribution measurements. The probe maintains a compatible pressure environment for the spectrometer during rocket firings and generates a molecular beam which is representative of the plume gas dynamic state at a given sampling point. The modulated beam technique for both density and velocity distribution measurements is described. The important criteria for the design of the more important features are discussed. Sample data from calibration sources and the thruster are presented along with analysis of the data as it relates to parameter spatial dependence and kinetic temperatures calculated from the velocity distributions. Author (GRA)

N72-14472# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF BIOLOGICAL CYBERNETICS. CURRENT PROBLEMS OF MACHINE ANALYSIS OF BIOLOGICAL STRUCTURES
M. V. Girina, N. A. Kozlova, V. K. Pozdneev, V. V. Vasilchikov, and V. G. Tyazhelova 16 Jul. 1971 25 p refs Transl. into ENGLISH from the Monograph Problemy Biologicheskoi Kibernetiki, Sovremennye Problemy Mashinnogo Analiza Biologicheskikh Struktur (Moscow), 1970 p 22-27, 95-101
(FTD Proj. 60101)
(AD-729084; FTD-HT-23-324-71) Avail: NTIS CSCL 20/6

Contents: Television microscopic particle counter; Application of a potential-functions device to the problem of analyzing infrared spectra. GRA

N72-14473# Naval Research Lab., Washington, D.C.
AIRBORNE RADIAC Progress Report, 1 Jul. - 31 Dec. 1970
Charles W. Peters and M. Odell Rhue Jul. 1971 9 p refs
(NRL Proj. H01-32)
(AD-729254; NRL-MR-2303) Avail: NTIS CSCL 18/4

The report discusses the design and development of a

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Flyable Breadboard and an NRL-Breadboard of the Airborne Radiac. The NRL-Breadboard has been completed. The Flyable Breadboard is completed except for delivery of the data convertor and final tests. Computer calculations of the detector response have been completed by the U. S. Army Nuclear Effects Laboratory and are being analyzed to determine the best analytical response function for the detector. Author (GRA)

N72-14474# Ohio State Univ. Research Foundation, Columbus.
ANALYTICAL PHOTOGRAMMETRY: A COLLINEAR THEORY Final Technical Report
Lee U. Bender Aug. 1971 112 p refs
(Contract F30602-70-C-0094; Job Order 55690000)
(AD-729434; RADC-TR-71-147) Avail: NTIS CSCL 08/2

A collinear theory of photogrammetry is developed through the employment of homogeneous coordinates and generalized matrix inverses. Chapter I outlines the basic concepts used in the succeeding chapters. In Chapter 2, Abbe's theory of optical instruments is introduced as the foundation upon which the present theory is built. The distinguishing facet of Abbe's theory is its basic postulate which asserts (regardless of the mechanism by which it is accomplished) that there exists a one-to-one relationship between the object and its image. Through this postulate one arrives at the conclusion that a three-dimensional, non-singular projective transformation (collineation) relates object and image. Next, Chapter 3 investigates in some detail the photograph as a singular collineation. Chapter 4 covers the theory of photographic stereo-pairs. In the final section, Chapter 5, empirical instrumental relative orientation is shown to be analogous to the Gauss-Seidel methods. Author (GRA)

N72-14475# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
PROPOSED IMPROVEMENTS IN THE SDC SPACETRACK OPTICAL OPERATIONS BASED ON A STUDY OF SKY BRIGHTNESS AND EXTINCTION EFFECTS IN LIMITING THE BAKER-NUNN CAMERA SYSTEM
Louis S. Macknik and Kenneth E. Kissell Jun. 1971 74 p refs
(AF Proj. 7114)
(AD-729812; ARL-71-0086; DoD-Element-61102F; DoD-Subelement-681301) Avail: NTIS CSCL 14/5

The report is the result of a six month study of the problem of atmospheric extinction and sky brightness effects on the performance of the Baker-Nunn Camera System. This study included the construction of a special sky brightness photometer, the conduct of 30 days of observation in conjunction with the Edwards AFB camera, and the analysis of the results.
Author (GRA)

N72-14476# RAND Corp., Santa Monica, Calif.
A PHOTOGRAPHIC TECHNIQUE FOR IMAGE ENHANCEMENT: PSEUDOCOLOR TWO SEPARATION PROCESS
Roy Stratton and Carl Gazley, Jr. Jul. 1971 45 p refs
(Contract F44620-67-C-0045)
(AD-729754; R-597-PR) Avail: NTIS CSCL 14/5

A method for transforming each tone of gray in a black-and-white image into a different color, enabling viewers to extract more information is presented. Using only two intermediate separations, red and blue, the process is even simpler and faster than the red/green/blue process reported in AD-717143. It also gives a more evenly spaced range of hues. However, with the improvements described in the report, the three-separation technique has the greater flexibility. In the two-separation process: One separation is made from the original positive and developed; Another is contact-printed from the first--not emulsion-to-emulsion--and developed; The first is contact printed, emulsion-to-emulsion, on color film, using a red light source; With careful image registration, the second is contact-printed, emulsion-to-emulsion, on the same material under a blue light; The print is processed. Examples are included. Author (GRA)

N72-14477# Army Chemical Center, Edgewood, Md.
A THREE-DIMENSIONAL QUADRUPOLAR MASS ANALYZER. PART 2: OPERATIONAL CHARACTERISTICS Technical Report, Jun. 1969 - Dec. 1970
Peter E. Wagner and Charles S. Harden Sep. 1971 28 p refs
(DA Proj. 1B6-62710-AD-29; DA Proj. 1B6-62708-AD-18)
(AD-729788; EA-TR-4545-Pt-2) Avail: NTIS CSCL 14/2

The properties of a 3DQ mass analyzer constructed are described. Ion-generation and withdrawal pulses are made coherent with the radio frequency (hf) driving voltage. This allows the rf phase dependence of these events to be measured; in addition, lifetimes of stored ions can be conveniently measured. Representative results of lifetime studies on N2(-) at various background pressures and rf frequencies are given. The maximum intensity and the area of the N2(-) peak are observed as functions of the dc-to-rf voltage ratio, rf frequency, repetition rate of the ionization withdrawal sequence, background pressure, and storage time. Author (GRA)

N72-14478# Coast Guard, Washington, D.C. Applied Technology Div.
THE APPLICABILITY OF REMOTE SENSOR TECHNIQUES FOR OIL SLICK DETECTION
Clarence E. Catoe 25 Feb. 1971 29 p refs
(CG Proj. 714104)
(AD-728422; USCG-71404-(A)-009) Avail: NTIS CSCL 13/2

The applicability of remote sensing techniques to the detection of oil films on water is furnished. Short reviews of various imaging techniques and their feasibility as oil film detectors are provided. The results of Coast Guard sponsored research to develop characteristics signatures for sensors operating in the UV to microwave of the electromagnetic spectrum are given. Field test results of existing passive and active sensors obtained from oil spill overflights is presented. Author (GRA)

N72-14479# ARO, Inc., Arnold Air Force Station, Tenn.
DEVELOPMENT OF CALIBRATION INSTRUMENTATION FOR ABLATION FACILITIES Final Report, Jul. 1970 - Jul. 1971
J. C. Pigott, R. T. Smith, and W. N. MacDermott AEDC Sep. 1971 62 p refs
(Contract F40600-72-C-0003; AF Proj. 627A; ARO Proj. PW3107)
(AD-730273; AEDC-TR-71-172; ARO-PWT-TR-71-124; Program-Element-63311F) Avail: NTIS CSCL 14/2

Results are presented from a program conducted to develop calibration instrumentation for ablation facilities. The investigation included the development and evaluation of a transient total enthalpy probe, a stagnation point heat-transfer probe, and total pressure probes. A laser shadowgraph was developed for visualization of the flow field. Testing was conducted in the AEDC-PWT arc heater test unit (5 MW). Uncooled probes swept through the flow at high velocity (10 to 40 in./sec) survived the severe heat-transfer conditions and the desired data were obtained. The results of this investigation and a description of the calibration instrumentation are presented. Author (GRA)

N72-14480# Signals Research and Development Establishment, Christchurch (England).
A VOLTAGE CONTROLLED DELAY GENERATOR
K. G. Roots Jan. 1970 13 p
(AD-730333; SRDE-70044; TRC-BR-25649) Avail: NTIS CSCL 14/2

A voltage controlled delay generator is described which permits sampling techniques to be used to improve signal/noise ratios of experimental, repetitive, waveforms. The use of a slowly rising linear ramp voltage to provide a continuously variable delay of a pulse relative to a clock pulse provided a significant increase in the accuracy of sampling over a previous scheme which relied upon a mechanical method to control the variable delay potentiometer of a pulse generator. A voltage versus time ramp in excess of one hour is possible by using pulses to control the charging rate of a capacitor connected in an insulated gate field effect transistor circuit. Author (GRA)

N72-14481# Little (Arthur D.), Inc., Cambridge, Mass.
TILTMETER INSTRUMENTATION FOR DEEP HOLE OPERATION Annual Technical Report, 15 Jun. 1970 - 14 Jun. 1971
Ivan Simon, Martin L. Cohen, Robert E. Elcox, C. Russell Smallman, Robert Lucas, and Joseph B. Walsh 14 Jun. 1971 51 p refs
(Contract F44620-70-c-0074; ARPA Order 1584; Proj. AO-1584)
(AD-729969; AFOSR-TR-71-2419; C-72720) Avail: NTIS CSCL 14/2

A deep-hole tiltmeter system was developed and constructed for the purpose of measuring and recording two components of tilt resulting from changes in earth strain associated with tectonic processes or geotechnical operations such as fluid injection. The downhole unit is designed so as to permit continuous operation in wells up to 3000 m (9200 ft) deep at temperatures as high as 120C and fluid pressures up to 5000 psi. The drift diameter of the smallest well casing in which the downhole unit can be placed is 5.55 in. The instrument is lowered in the well by a 7-conductor, double-armored cable and firmly attached to the well casing at the specified depth by a remotely operated holelock. The instrument can be retrieved using the same cable. The electronics system allows selective execution of commands for several (presently seven) different functions of the downhole unit. Author (GRA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-14482 National Lending Library for Science and Technology, Boston Spa (England).
THE THEORETICAL BASIS FOR EVALUATION OF WELD QUALITY
J. Angress 24 Sep. 1971 22 p refs Transl. into ENGLISH from Przeglad Spawalnictwa (Warsaw), v. 21, no. 3, Mar. 1969 p 56-62
(NLL-SMRE-Trans-5902-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Three methods of approaching the study of welds are considered. Standard weld radiographs can be used for relatively equally loaded welds in similar structures. Description and measurement of a chosen parameter of weld defetcs (type, number, intensity, location, etc.) may provide the basis for weld classification into grades. Assessment of welds on the basis of reduction in load-carrying capacity due to defects comprises the third method of analysis. Equations are presented for calculating the reduction of weld strength and coefficients. K.P.D.

N72-14483*# General Dynamics/Convair, San Diego, Calif.
PREPARATION AND EVALUATION OF APOLLO 14 COMPOSITE EXPERIMENTS
W. H. Steurer and S. Kaye Aug. 1971 70 p
(Contract NAS8-24979)
(NASA-CR-61368; GDCA-DBG71-009) Avail: NTIS CSCL 13H

An account is given of the work aimed at flight experiments on Apollo 14, in relation to space manufacturing processes. Evaluation of suitable materials, definition of in-flight processing procedures, preparation of preprocessed materials and delivery, and evaluation of the space-processed samples after return from the Apollo 14 flight are presented. Author

N72-14484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A TECHNIQUE FOR MAKING CLEAN HOLES IN METALLIC PIPING AND COMPONENTS
Thomas P. Hecker Washington Jan. 1972 14 p
(NASA-TM-X-2431; E-6572) Avail: NTIS CSCL 13H

Testing was conducted to develop a technique of providing clean holes in process piping or in a metal surface accessible from one side only without disassembling the system. The method was performed on sample pieces of piping and worked successfully with no contaminants being found on the inside of the pipe. The materials tested were Inconel 600, 304 stainless steel, Hastelloy X, and ASTM-A53 black steel. The technique was developed such that it could be done in the field with hand-held power tools and a portable tungsten inert gas welding machine. Author

N72-14485*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FAILURE-RATE COMPUTATIONS BASED ON MARINER MARS 1969 SPACECRAFT DATA
Paul O. Chelson 1 Dec. 1971 21 p refs
(Contract NAS7-100)
(JPL-TR-32-1544; NASA-CR-125066) Avail: NTIS CSCL 14D

An analysis of in-flight spacecraft part hours and failure data from the Mariner Mars 1969 Project is given. It contains failure rates computed from this data for all electronic and electromagnetic parts on the Mariners 6 and 7 spacecraft. Also included are failure rates based on combining flight data from Mariners 4,5,6, and 7. Author

N72-14486*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Quality Assurance and Reliability Div.
RELIABILITY COMPUTATION FROM RELIABILITY BLOCK DIAGRAMS
Paul O. Chelson and R. Eric Eckstein 1 Dec. 1971 29 p refs
(Contract NAS7-100)
(NASA-CR-125068; JPL-TR-32-1543) Avail: NTIS CSCL 14D

A method and a computer program are presented to calculate probability of system success from an arbitrary reliability block diagram. The class of reliability block diagrams that can be handled include any active/standby combination of redundancy, and the computations include the effects of dormancy and switching in any standby redundancy. The mechanics of the program are based on an extension of the probability tree method of computing system probabilities. Author

N72-14487*# Franklin Inst., Philadelphia, Pa.
FINITE ELEMENT SOLUTION OF LUBRICATION PROBLEMS Technical Report, 18 Feb. 1970 - 18 Feb. 1971
M. M. Reddi 18 Feb. 1971 65 p refs
(Contract NAS3-13480; Proj. 32G-C2762-01)
(NASA-CR-125069; F-C2762) Avail: NTIS CSCL 11H

A variational formulation of the transient lubrication problem is presented and the corresponding finite element equations derived for three and six point triangles, and, four and eight point quadrilaterals. Test solutions for a one dimensional slider bearing used in validating the computer program are given. Utility of the method is demonstrated by a solution of the shrouded step bearing. Author

N72-14488*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATION OF THE RETENTION CHARACTERISTICS OF SCREWED CONNECTIONS UNDER DYNAMIC LOAD EXPOSURE
E. G. Paland Washington NASA May 1971 42 p refs Transl. into ENGLISH from "Untersuchungen uber die Sicherungseigenschaften von Schraubenverbindungen bei Dynamischer Belastung" (Doctoral Dissertation), Technische Hochschule Hannover, 30 Jun. 1966 p 3-45, 116-118
(Contract NASw-2038)
(NASA-TT-F-13857) Avail: NTIS CSCL 13E

Possible causes for reduction of the initial stressing force in a screwed connection are discussed. Theoretical and experimental clarification of the problem of conditions under which the

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unscrewing of a screwed connection under dynamic load is possible are advanced, and the basic effect of some locking elements on the unscrewing behavior of screwed connections is investigated. Author

N72-14489# Joint Publications Research Service, Washington, D.C.
DESIGN PRINCIPLES OF NUMERICAL PROGRAMMED CONTROL OF ARC AND ELECTRON BEAM WELDING
G. A. Spynu, V. I. Agrebel'nyy, Yu. I. Pastushenko, and O. K. Nazarenko 7 Jan. 1972 5 p ref Transl. into ENGLISH from Avtomat. Svarka (Kiev), no. 8, 1971 p 23-25 Presented at All-Union Conf. on Autom. Control of Welding Processes, Kiev, 13-14 Oct. 1970
(JPRS-54875; UDC-621.791.75.002.5) Avail: NTIS

Two digital programmed control systems are described. The first system was developed for arc welding large parts with a fusing electrode in a protective gas. The system was designed for automatic control of the electrode along the seam of the joined parts, and for control of the operations involved in the beginning and end of the weld. It consists of a special welding head mounted on the assembly line equipment, and a digital programmed control desk. The second system was developed for automatically welding large parts by the multipath electron beam process, and includes preliminary program recording. The system consists of a device for automatic correction of the electron beam with respect to the seam, and a programmed control system desk connected with the electron beam machine through an electromagnetic deflecting system. D.L.G.

N72-14490# Joint Publications Research Service, Washington, D.C.
DIGITAL SYSTEMS FOR AUTOMATING THE DESIGN AND PRODUCTION OF PARTS
G. A. Spynu and Yu. G. Zarenin 7 Jan. 1972 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Tekhn, Kibernetika (Moscow), no. 3, 1969 p 43-52
(JPRS-54874) Avail: NTIS

A single class of systems designed for the automation of the basic steps in the process of manufacturing parts in machine construction (structuring, technical design, and manufacture on metal-cutting machines) is considered. The schematic of a generalized digital system is given involving unknown and, as a rule, assembly-line manufactured devices. Some basic problems in the construction of systems of this type are considered; the determination of the rational amount of identical devices to be used in the individual steps; determination of the economic requirements of system reliability; and the algorithmic languages in digital systems. Some ideas of economic efficiency are discussed. Two systems which were developed and are in operation are described. Author

N72-14491# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
STOCHASTIC BEHAVIOR OF A TWO-UNIT STANDBY REDUNDANT SYSTEM
Toshio Nakagawa (Meijo Univ.) and Shunji Osaki Oct. 1971 16 p refs
(Grant GM-16197-03)
(TR-71-37) Avail: NTIS

The stochastic behavior of a two-unit standby redundant system is presented, with the generalized assumptions that both the failure and repair time distributions of each unit are arbitrary. The first-passage time distributions, the transition probabilities, and the limiting probabilities are derived by using a modification of the regenerative point techniques of Markov renewal processes. Author

N72-14492# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
OPTIMUM PREVENTIVE MAINTENANCE POLICIES MAXIMIZING THE MEAN TIME TO THE FIRST SYSTEM FAILURE FOR A TWO-UNIT STANDBY REDUNDANT SYSTEM
Shunji Osaki and Toshio Nakagawa (Meijo Univ.) Dec. 1971 24 p refs
(Grant GM-16197-04)
(TR-71-43) Avail: NTIS

A two-unit standby redundant system is considered with respect to repair and preventive maintenance. The following two assumptions are made: (1) The inspection of an operative unit is made only if the other unit is on standby. (2) An operative unit, which forfeited inspection under assumption (1), undergoes inspection only upon completion of repairs made to the failed unit (or after inspection of the failed unit). The Laplace-Stieltjes transform of the cumulative distribution function is derived for the length of time to first system failure and for the mean time to failure. Furthermore, the necessary and sufficient conditions for an optimum preventive maintenance policy were obtained with respect to the mean time to failure. For certain conditions, the analytical form of an optimum inspection time was found, which maximizes the mean time. A numerical example is presented. Author

N72-14493*# Aerojet Liquid Rocket Co., Sacramento, Calif.
AN EVALUATION OF A HUBLESS INDUCER AND A FULL FLOW HYDRAULIC TURBINE DRIVEN INDUCER BOOST PUMP
B. K. Lindley and A. R. Martin Oct. 1971 136 p refs
(Contract NAS3-11218)
(NASA-CR-72995; Rept-11218-F) Avail: NTIS CSCL 13K

A study was conducted to compare the performance of several configurations of hubless inducers with a hydrodynamically similar conventional inducer and to demonstrate the performance of a full flow hydraulic turbine driven inducer boost pump using these inducers. Results of the study indicate that the suction performance of the hubless inducer is not significantly better than that of the conventional inducer after accounting for the larger inlet tip blade angle. It was concluded that the hubless inducers can best be used when the available drive power is at the outer shroud. Tests of the full flow hydraulic turbine drive boost pump indicate that it has potential for use with high speed pumps. It has the ability to start very quickly and maintain an almost constant speed ratio over the entire flow speed range. The performance limiting component was the high speed rotor, which cavitated more than expected. It is suggested that the rotor cavitation performance could be improved by decreasing the hub/tip diameter ratio. D.L.G.

N72-14494*# Techtran Corp., Glen Burnie, Md.
ON THE MEASUREMENT OF COLLECTING EFFICIENCY OF FILTERS FOR SUBMICRON AEROSOL PARTICLES
Toshio Sekikawa Washington NASA Jan. 1972 15 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Tokyo), v. 11, Jan. 1969 p 8-13
(Contract NASw-2037)
(NASA-TT-F-14086) Avail: NTIS CSCL 13K

A method was developed for measuring the collecting efficiency of a mechanical filter for the submicron aerosol particles. The principle of the method is based on the mobility spectra of ions artifically brought to a charge equilibrium by means of uncharged aerosols. From these measurements, it was found that even a high efficiency filter made of nonwoven cloth has an average collecting efficiency of only 50% when the radii of the submicron aerosol particles are on the order of 0.000001 cm. It was also revealed that the efficiency of such filters was lowest whenever the collected particles have radii equivalent to 4 or 5 x .000001 cm. Author

N72-14495*# National Aeronautics and Space Administration, Washington, D.C.
MACHINE TOOLS AND FIXTURES: A COMPILATION Technology Utilization
1971 29 p
(NASA-SP-5910(04)) Avail: NTIS HC $1.00/MF $0.95

CSCL 13I

As part of NASA's Technology Utilizations Program, a compilation was made of technological developments regarding machine tools, jigs, and fixtures that have been produced, modified, or adapted to meet requirements of the aerospace program. The compilation is divided into three sections that include: (1) a variety of machine tool applications that offer easier and more efficient production techniques; (2) methods, techniques, and hardware that aid in the setup, alignment, and control of machines and machine tools to further quality assurance in finished products: and (3) jigs, fixtures, and adapters that are ancillary to basic machine tools and aid in realizing their greatest potential. D.L.G.

N72-14496*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

BUTT WELDER FOR FINE GAUGE TUNGSTEN/RHENIUM THERMOCOUPLE WIRE Patent Application

Walter P. Kabana and Charles B. King, inventors (to NASA) Filed 31 Dec. 1970 11 p

(NASA-Case-LAR-10103-1; US-Patent-Appl-SN-10-3230) Avail: NTIS CSCL 13H

An electrical resistance butt welder for welding fine gage wire or other metal parts with small cross sections is described. It includes a vacuum chuck which is constructed of two parts bonded together by an electrically insulating epoxy layer. A straight groove in the surface of the chuck, shaped to receive the wires, extends across the chuck perpendicular to the bondline. Orifices from this groove lead to the interior of the chuck which is evacuated. Two bow shaped copper electrodes are lowered to touch each wire. As the electrodes are pressed against the wire, the electrodes produce forces which press the ends of the wires together. Current is pulsed through the electrodes, and a fusion weld is formed at the butt juncture. F.O.S.

N72-14497*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MICROCIRCUIT NEGATIVE CUTTER Patent Application

Douglas W. Whipple and Earl R. Blymiller, inventors (to NASA) Filed 4 Aug. 1970 12 p

(NASA-Case-XLA-09843; US-Patent-Appl-SN-60876) Avail: NTIS CSCL 13I

A device for cutting negatives for screen circuits and other microcircuits which require precision layout is described. It is a manually operated X-Y coordinate cutter for making surface cuts with great accuracy in three cutting dimensions. The cutting blade is rotated to cut in the X or Y direction and adjusted, in combination with a roller which contacts the work, to make cuts of uniform depth in the work. The roller and cutting blade are spring-mounted to ride smoothly over surface irregularities while maintaining a constant cutting depth. A pattern, placed between a translucent cutting surface and a translucent workpiece, is illuminated by a light box for use as a rough guide during cutting operations. X-Y dimensions of the cuts are laid out from a reference point on the pattern by positioning the cutting blade with verniers. NASA

N72-14498*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.

DEVELOPMENT OF THE ACTIVATED DIFFUSION BRAZING PROCESS FOR FABRICATION OF FINNED SHELL TO STRUT TURBINE BLADES

L. G. Wilbers, T. F. Berry, R. E. Kutchera, and R. E. Edmonson Nov. 1971 151 p refs

(Contract NAS3-12433)

(NASA-CR-72844) Avail: NTIS CSCL 13H

The activated diffusion brazing process was developed for attaching TDNiCr and U700 finned airfoil shells to matching Rene 80 struts without obstructing the finned cooling passageways. Creep forming the finned shells to struts in combination with precise preplacement of brazing alloy resulted in consistently sound joints, free of cooling passageway clogging. Extensive tensile and stress rupture testing of several joint orientations at several temperatures provided a critical assessment of joint integrity of both material combinations. Trial blades of each material combination were fabricated followed by destructive metallographic examination which verified high joint integrity.

Author

N72-14499# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COMPARATIVE WEAR RESISTANCE OF DIFFUSION LAYERS

L. G. Voroshnin, L. S. Lyakhovich, and Ya. N. Funshtein 25 Jun. 1971 14 p refs Transl. into ENGLISH from Khimiko-Termicheskaya Obrabotka Stlai i Splavov (USSR), 1969 p 138-141

(AF Proj. 7345)

(AD-729039; FTD-MT-24-44-71) Avail: NTIS CSCL 13/8

Steels 20, 25, 45 and 25KhGT, after surface hardening by various diffusion methods, were subjected to abrasive wear tests. The highest resistance to wear in rolling friction was observed after holding 2 hr in a given melt containing 3 percent of a given composition at 850 degrees, followed by immediate quenching in water or oil; gas carburizing (in natural or synthetic gas), high temperature cyaniding (in a given molten mixture at 920 degrees), and nitrocarburizing (in a mixture of ammonia and kerosene at 880 degrees) produced surfaces of lower wear resistance. The highest resistance in sliding friction was obtained in the case of steel 45 after boronizing for 5 hr in a given melt at 980-1000 degrees, immediately followed by quenching in oil and tempering for 90 min at 250 degrees; boronizing in a given melt resulted in somewhat lower wear resistance, but the wear resistance of all boronized steel 45 samples was still much higher than that of steels 20 and 25 KhGT after any of the above mentioned carburizing treatments. GRA

N72-14500# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE QUESTION OF INCREASE OF THE RELIABILITY OF HIGH STRENGTH STEEL WELD JOINTS

V. M. Nikitin and V. A. Rodionov 29 Jun. 1971 16 p refs Transl. into ENGLISH from Mosk. Vysshee Tekhn. Uchilishche, Sb. (Moscow), no. 133, 1969 p 166-174

(FTD Proj. 60107)

(AD-729041; FTD-MT-24-53-71) Avail: NTIS CSCL 13/5

The technology and a device were developed for successive upsetting of edges under constrained conditions of deformation, which allows regulating the geometry of the thickened edge in wide limits. Thickening of the edges allows regulating the efficiency of weld joints due to the variation of properties of the metal of the seam. It is established that weld joints with thickened edges possess a reduced tendency toward brittle rupture. Author (GRA)

N72-14501# Mechanical Technology, Inc., Latham, N.Y.

DEVELOPMENT STUDIES ON UTILIZING THE SELF-CAGING SPHERICAL BEARING FOR DIRECTIONAL GYROSCOPES

Richard L. Smith and Salvadore J. Calabrese Jul. 1971 60 p refs

(Contract DAAH01-70-C-1111)

(AD-729376; MTI-71TR39) Avail: NTIS CSCL 17/7

Under this contract from the Army Missile Command at Redstone Arsenal, Alabama, Mechanical Technology Inc. carried forward the development of the self-caging, rubber, spherical gas bearing for use in directional gyroscopes. A high-pitched, audible squeal originating from within the first compliant rubber gas bearing was traced to its origin and performance data were revealed which indicated the likelihood of the squeal's interference with the gyro performance characteristics. Variations in the gas venting and feeding to the gyro bearing were studied along with performance tests of compliant surfaces with various orifice feed holes. Data gathered revealed that the bearing performance varied significantly depending on whether the compliant material was placed on the male or female components. The gas feeding

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experiments revealed many previously unknown characteristics of gas flow through inertial bearing surfaces which contain compliant materials such as silicone rubber. The investigation also revealed tolerance variations which do exist in a sample set of moldings as well as the changes in bearing performance which result from these dimensional variations. The studies also included experiments which determined gyro drift rates (both static and dynamic), caging ability of the as-molded test bearing plates, and the load carrying capability of the operating gyro bearing.
Author (GRA)

N72-14502# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF THE AFADL DISK TESTER FOR GEAR LUBRICATION RESEARCH Phase Report, 1 Oct. 1969 - 1 Apr. 1971
H. J. Carper, E. L. Anderson, and P. M. Ku Wright-Patterson AFB, Ohio AFAPL Aug. 1971 53 p refs
(Contract F33615-69-C-1295; AF Proj. 3048)
(AD-729441; SWRI-RS-572; AFAPL-TR-71-63; Task-304806) Avail: NTIS CSCL 13/9

The report describes the design and development of a disk-type tester for use in experimental investigations of gear lubrication with emphasis on scuffing. This tester features two independently-driven test disks, dual torque-monitoring system, and high-temperature and atmospheric-control capabilities; and represents considerable advancement over most of the disk-type testers currently in use. The methods for determining disk friction and disk surface temperature are discussed and preliminary calibration results are given. Preliminary scuffing results are also presented for three lubricants (a straight mineral oil, a MIL-L-7808G lubricant, and a MIL-L-23699 lubricant) run with test disks made of AMS 6260 steel. Author (GRA)

N72-14503# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF CONCENTRATED ENERGY FLUXES ON MATERIALS
Yu. L. Krasulin, N. N. Rykalin, and M. Kh. Shorshorov 12 Jul. 1971 17 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 4, 1967 p 5-10
(AF Proj. 7JJ)
(AD-730079; FTS-HT-23-887-71; PIA-Task-T66-01-8) Avail: NTIS CSCL 13/8

The article is an examination of the peculiarities and the mechanism of the effect of concentrated energy sources on materials (electron beam, laser beam, shock waves of explosives and electrical explosion of wires) with various forms of treatment (cutting, dimensional machining, melting, welding, deforming, strengthening, the application of coatings). Special attention is given to pulse effect. Trends of future investigations in this region are examined. Author (GRA)

N72-14504# Hamilton Standard, Windsor Locks, Conn.
LIGHTWEIGHT GEARBOX DEVELOPMENT FOR PROPELLER GEARBOX SYSTEMS APPLICATIONS. PHASE 1: DEVELOPMENTS OF ION-SPUTTERED COATINGS FOR TITANIUM ALLOY GEARS Technical Report, Feb. 1970 - 31 Mar. 1971
E. J. Delgrosso, E. A. Fahy, E. L. Paradis, and D. J. Quinn Wright-Patterson AFB, Ohio AFAPL Aug. 1971 66 p refs
(Contract F33615-70-C-1391; AF Proj. 3066)
(AD-729839; HSER-5832-Ph-1; AFAPL-TR-71-41-Ph-1) Avail: NTIS CSCL 13/9

A process known as ion-sputtering was utilized to deposit several coating compounds on titanium gear tooth surfaces. Roller tests and small scale gear tests were utilized in the coating evaluation. The evaluation did indicate some potential for WC - 14% Co coating on a titanium substrate. However, surface imperfections are considered to have reduced the test duration significantly from that expected. Author (GRA)

N72-14505# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REGULARITIES OF SOFTENING OF THERMALLY HARDENED STEELS DURING WELDING
V. I. Logvinov 14 Jul. 1971 22 p refs Transl. into ENGLISH from Inst. Nefteckhimcheskoi i Gazovi Prom., Tr. (Moscow), no. 70, 1967 p 73-83
(FTD Proj. 60108)
(AD-730047; FTD-MT-24-131-71; DIA-T65-01-82; DIA-T65-01-83) Avail: NTIS CSCL 13/5

During welding of thermally hardened steel a new phenomenon must be reckoned with - softening in the heat affected area. As a result of welding heat in the weld joint there is formed a soft interlayer, which disturbs the mechanical homogeneity. The provision of uniform strength and mechanical homogeneity of the weld joint is the basic specific problem of welding of the thermally hardened steels, for the solution of which it is necessary to find methods of controlling the processes of softening. In connection with this the regularities of softening are of interest, the knowledge of which permits rationally directing the development of the chemical composition of new mild steels and welding technology, and also permits considering the effect of the soft interlayer when designing structures. In certain cases, in the author's opinion, the reasons for the limitation of softening by the chemical composition of steel are erroneously explained, which can lead to the irrational consumption of scarce alloying elements. Author (GRA)

N72-14506# Naval Air Systems Command, Washington, D.C. Professional Development Center.
THE PREPARATION OF A SPECIFICATION FOR HYDRAULIC FLUID FILTERS FOR AIRCRAFT GROUND SUPPORT EQUIPMENT
W. C. Boswell, Jr. 9 Jul. 1971 39 p refs
(AD-730027; SP-71-01) Avail: NTIS CSCL 13/7

The use of a hydraulic fluid to transmit power in aircraft presents many problems. One of the major areas of concern is fluid contamination. The contamination may take the form of inorganic material, metal particles, other minute particles, and water. This contamination requires that aviation ground support equipment be designed to eliminate as much as possible. The report deals with the preparation of a specification for ground support equipment hydraulic filters. Much of the theory concerning filtration is empirical in nature. This paper attempts to justify some of the empirical tests with theoretical work presented in the literature. Further, some of the requirements of the specification are included where appropriate. Author (GRA)

N72-14507# Naval Ordnance Lab., White Oak, Md.
SURVEY OF FIRES IN HYPOBARIC AND HYPERBARIC CHAMBERS
Raymond S. Alger and John R. Nichols 20 Jul. 1971 45 p refs
(NOL Proj. 394/NFEC-101)
(AD-730031; NOLTR-71-128) Avail: NTIS CSCL 13/12

The design of fire detection and suppression equipment requires some knowledge of the fire characteristics for the particular fuels and environments involved. In order to provide these characteristics for hyperbaric chambers, evidence from the most recent fires in British, Japanese, and U.S. chambers was examined and summarized. Items of particular interest are the conditions for ignition, e.g., the fuel, environment, and source of heat, the pattern and mechanism of fire spread; the degree of fuel involvement; the time required to develop a lethal environment; the results of fire suppression and rescue efforts. The evidence suggests a variety of design features and operational procedures which can reduce fire hazards in hypobaric and hyperbaric installations. Author (GRA)

N72-14508# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
FAILURE MECHANISM OF ATTITUDE CONTROL SYSTEM VALVE IN CHLORINE PENTAFLUORIDE SERVICE Final

Technical Report, Jul. 1970 - Mar. 1971
W. David English and Hubert D. Samuel, Jr. Wright-Patterson AFB, Ohio AFML Jul. 1971 307 p refs
(Contract F33615-70-C-1760)
(AD-729874; AFML-TR-71-94; MDC-G2275) Avail: NTIS CSCL 13/11

As part of a continuing Air Force effort to develop component technology for high-energy propulsion systems, an attitude control system (ACS) valve was developed elsewhere for use with high-energy storable liquid propellants. This valve performed successfully in most propellants tested; however, it failed by developing excessive leakage when operated in chlorine pentafluoride. The design and operation of the ACS valve were analyzed for mode of possible failure. The modes studied included overstressing of the closures by closing loads; adhesive wear of the closure surfaces/corrosion of the closures by CPF, and hydrofluoric acid/abrasive wear; corrosive wear; and impact-initiated chemomechanical reactions. Some new equations which relate valve wear to operating and material parameters were developed during the analysis. Tests of some materials were conducted to supply data for certain of the analyses, to test the equations used, and to evaluate some candidate materials. For all of the normal modes of possible failure investigated, it was demonstrated conclusively that the valve is adequately designed to withstand any expected level of load or attack. MDAC has shown by analysis and test that impact-initiated chemomechanical reaction of absorbed water with CPF on the closure surfaces will result in failure of the type observed.
Author (GRA)

N72-14509# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
MANUFACTURING METHODS FOR MACHINING PROCESSES FOR HIGH MODULUS COMPOSITE MATERIALS. VOLUME 2: COMPOSITES MACHINING HANDBOOK
F. Hanley and J. H. Doran Wright-Patterson AFB, Ohio AFML 12 Jul. 1971 97 p
(Contract F33615-70-C-1427)
(AD-729877; AFML-TR-71-129-Vol-2) Avail: NTIS CSCL 13/8

The volume is a composites machining handbook for use by engineering and production personnel concerned with fabrication of advanced composite structures. The handbook recommends specific cutting tools and machine tool setting for drilling, reaming, countersinking, milling, routing, and sawing boron-epoxy and boron-epoxy/titanium laminate. Author (GRA)

N72-14510# Battelle Memorial Inst., Columbus, Ohio.
DESIGN AND EVALUATION OF ADVANCED HIGH-SPEED FUEL PUMP Final Technical Report
Harry T. Johnson Jul. 1971 64 p ref
(Contract DAAJ02-69-C-0072; DA Proj. 1G1-62203-D-144)
(AD-729867; USAAMRDL-TR-71-37) Avail: NTIS CSCL 13/11

The purpose of this program was to develop both the technology and the experimental hardware to experimentally demonstrate that a main-engine fuel pump could be operated at turbine-engine shaft speeds. A single-lobe vane pump has been designed and successfully operated at speeds up to 49,500 rpm and outlet pressures up to 900 psig while pumping JP-4 turbine fuel. The promising capabilities demonstrated by this pump were the result of the successful application of hydrodynamic lubrication techniques to the vane design. The pivoting vane tip concept incorporated permits tip surface speeds up to 180 fps to be achieved without producing high mechanical power losses or sacrificing the pump endurance capabilities. The present experimental fuel pump represents a significant step toward the development of flight hardware capable of operating at engine shaft speed. It meets the basic performance requirements of a main-engine fuel pump typically required on small, highspeed gas-turbine engines. In addition, it appears that a variable-displacement capability could be developed directly from the present hardware without altering the established high-speed capabilities. Author (GRA)

N72-14511# Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.
CYCLE TESTING OF ACS VALVES IN CIF5 Technical Report, Apr. 1970 - Dec. 1971
Garreth J. Gunderson Aug. 1971 77 p refs
(AF Proj. 305802DRP)
(AD-730275; AFRPL-TR-71-92) Avail: NTIS CSCL 13/11

The report documents testing conducted to establish a seat and poppet material and/or sealing concept for use in chlorine pentafluoride (CIF5) attitude control system (ACS) valves. Test results of nickel-, iron-, tungsten-, and zirconium-based materials in the flat-on-flat sealing concept as well as a sapphire/copper lip-seal concept are discussed. In tests conducted to date, two varieties of tungsten carbide in the flat-on-flat configuration (Kennametal 96 and Kennametal 801) are the only materials that have met the leakage requirement of 30 scc helium/hour after 100,000 actuations in CIF5. Author (GRA)

N72-14512# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
TURBULENCE AND INERTIA EFFECTS IN THE ALIGNED FACE SEAL Ph.D. Thesis
Luther R. Wilhelm Aug. 1971 155 p refs
(Contract N00014-68-A-0144)
(AD-730723; ME-71-T57-12) Avail: NTIS CSCL 11/1

Using an order of magnitude analysis, the governing equations are derived for both laminar and turbulent flow in an aligned face seal. These equations contain inertia terms which have not been considered in previous analyses. Using a digital computer, the equations are solved for incompressible flow to find the leakage rate. The results are compared with calculations using a purely viscous theory with no inertia terms and also with calculations where only the centrifugal inertia term is considered.
Author (GRA)

N72-14513# Frankford Arsenal, Philadelphia, Pa.
A FLOW ANALOG FOR EXPLOSIVE BONDING
James F. Kowalick and D. Robert Hay (Drexel Univ.) Aug. 1971 34 p refs
(DA Proj. 1T0-61101-A-91-A)
(AD-730299; FA-A71-7; AMC-MS-Code-501A.11.84400.02) Avail: NTIS CSCL 13/8

Consideration of the microstructure of the explosive bond in terms of the generation of vortex periodicity in the wake of the re-entrant jet was used to yield a description of the mechanism of formation of the wavy interface. The analogy with aero- and hydrodynamic flows is consistent experimentally with observations in the latter systems in terms of flow patterns and characteristic dimensions. Reynolds numbers characteristic of the various flow regimes in the wake were measured experimentally and used as a quantitative criterion for describing the interface geometry. Thus, the hydrodynamic analogy is developed into a convenient method in practical applications of explosive bonding.
Author (GRA)

N72-14514# Curtiss-Wright Corp., Wood-Ridge, N.J.
STATIC AND ROTATING AIR/GAS SEAL EVALUATION Final Report
W. Paladini Jun. 1971 180 p refs
(Contract DAAJ02-70-C-0024)
(AD-730361; CW-WR-70-024F; USAAMRDL-TR-71-28; Task-1G162204A01409) Avail: NTIS CSCL 11/1

The report describes an evaluation of the leakage characteristics of the current gas turbine engine air/gas seals and sealing surfaces of small gas turbine engines. The evaluation included definition of probable air/gas leakage sources and paths in an engine possessing variable compressor and power turbine stator geometry, identification of sealing concepts currently in use, prediction of seal leakage in the small engine, rig testing of several static and rotating seals, and analysis of the effect of leakage on small engine performance. The rotating shaft seal tests were conducted on a fin-to-fin labyrinth seal and a carbon face contact seal. The casing flange seal tests were conducted

on metal-to-metal surfaces and on four metal seals for flanges. The variable-geometry vane trunnion seal tests were conducted on a fluorocarbon bushing and a metal bushing for the compressor and power turbine locations, respectively. Testing included leakage calibrations, and thermal cyclic and mechanical cyclic operation. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-14515 Rochester Univ., N.Y.
LASER-PUMPED RHODAMINE 6G DYE LASER Ph.D. Thesis
Gad Neumann 1970 155 p
Avail: Univ. Microfilms Order No. 71-1414

Laser cavity configurations consisting of Fabry-Perot-like dye cells, and a combination of these cells with a reflection diffraction grating are described. The dye solvent is ethyl alcohol and the pump excitation is the second harmonic or a neodymium Q-switched laser. It was found that the dye laser wavelength can be continuously tuned over a range of approximately 600 A by changing the dye concentration, solution length, and cavity reflectivity. This is interpreted in terms of a spectral gain analysis of the dye. However, when maximum power output is desired at each laser wavelength, severe restrictions are placed on the proper combination of the above interrelated parameters. It was concluded that there is no single value for each of these parameters which will optimize the laser power output at all wavelengths. Dissert. Abstr.

N72-14516 Alabama Univ., Huntsville.
A SELF-FOCUSING LASER RESONATOR Ph.D. Thesis
George A. Emmons 1970 161 p
Avail: Univ. Microfilms Order No. 71-1239

A theoretical analysis was performed on a zoned resonator and it was determined that both well-defined modes and a focused output could be obtained with a single optical element. This resonator was formed by two parallel mirrors (circular, plane, and equal in size) symmetrically placed about a common axis. One mirror had a uniform reflectivity of unity. The other mirror consisted of alternately transmitting and totally reflecting concentric zones. The reflecting zones provided the resonator feedback and the transmitting zones provided the output coupling. The transmission zones were arranged in a manner similar to those on a Fresnel zone plate. Scalar diffraction theory was used to describe the resonator modes, and a numerical iteration technique was used to determine the mode structure. The portions of these fields coupled out of the resonator were then used as sources, and the resulting external fields were determined. Dissert. Abstr.

N72-14517# Defense Documentation Center, Alexandria, Va.
LASER HAZARDS AND SAFETY A DDC bibliography, Dec. 1961 - May 1971
Aug. 1971 131 p refs
(AD-729830; DDC-TAS-71-42) Avail: NTIS CSCL 06/18

The references deal with the precautions employed, or suggested while working with, and administering laser equipment. Hazards to primates, and lower forms of life are discussed. Included are Corporate Author-Monitoring Agency, Subject, and Title indexes. GRA

N72-14518# Lockheed Missiles and Space Co., Palo Alto, Calif.
KINETICS OF A CHEMICAL HYDROGEN CHLORIDE LASER
V. I. Igoshin and A. N. Oraevskii [1971] 8 p refs Transl. into ENGLISH from Khim. Vys. Energ. (USSR), v. 5, no. 5, 1971 p 397-403
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

On the basis of the joint solution of equations of chemical kinetics, vibrational relaxation, and laser radiation generation, an analysis is given for a chemical laser using a mixture of hydrogen with chlorine. It is shown that the population inversion is maintained only in the initial stage of the reaction. Destruction of the inversion is due to the vibrational-vibrational exchange of energy in the molecule collisions. Qualitative recommendations are given for the selection of an optimal thermal mode and an optimal working mixture composition. Author

N72-14519# Joint Publications Research Service, Washington, D.C.
THE USE OF A HIGHLY IONIZED PLASMA FOR CREATION OF A LASER
L. I. Gudzenko, V. N. Kolesnikov, N. N. Sobolev, and L. A. Shelepin 7 Jan. 1972 4 p refs Transl. into ENGLISH from Magn. Gidrodin. (Riga), no. 3, Jul. - Sep. 1965 p 54-56
(JPRS-54881; UDC-553.9.01; CSO-0962172-S) Avail: NTIS

The principles and methods of using magnetohydrodynamic energy converters to create laser devices are discussed. Author

N72-14520# Weapons Research Establishment, Salisbury (Australia).
LASER BEAM TRANSFORMATIONS IN DIELECTRIC MEDIA
B. A. See Jul. 1971 21 p refs
(WRE-TN-407(AP)) Avail: NTIS

Generalized equations for beam transformations at dielectric interfaces are developed and applied to the problem of obtaining an exact solution to the confocal resonator containing multiple dielectric elements. Indirect confirmation of the validity of the model is presented by a frequency doubling experiment in which the second harmonic output is shown to have the full angular beam width calculated for the primary beam. Author

N72-14521# Northrop Corporate Labs., Hawthorne, Calif.
CO2 LASER PULSING TECHNIQUES Semiannual Report, Dec. 1969 - Dec. 1971
M. M. Mann Aug. 1971 37 p refs
(Contract N00014-70-C-0185; ARPA Order 306)
(AD-729263; NCL-71-41R) Avail: NTIS CSCL 20/5

In a study of CO2 Laser Pulsing Techniques, mode-locking and pulse coupling of a CO2 laser using a single electro-optic element have been demonstrated. Data on the effect of modulator detuning and coupling factor variation are presented. The preliminary results of an investigation of electro-optic techniques for AM and FM locking of TEA lasers are given. Author (GRA)

N72-14522# Northrop Corporate Labs., Hawthorne, Calif.
CARBON MONOXIDE LASER STUDIES, PART 1 Final Report, 1 Aug. 1970 - 31 Jul. 1971
Mani L. Bhaumik Aug. 1971 57 p refs
(Contract N00014-71-C-0037; ARPA Order 306)
(AD-729257; NCL-71-31R-Pt-1) Avail: NTIS CSCL 20/5

In an experimental and analytical study of carbon monoxide (CO) lasers, the characteristics of the laser have been determined and the dominant mechanisms identified. The study shows that in an electrically excited CO laser, the population inversion occurs due to pumping of the lower vibrational levels by electron impact followed by a harmonic pumping to the upper lasing levels. Overall efficiencies up to 47% have been achieved at 77K. The small signal gains of the various vibrational rotational lines were measured. The populations of the lasing level were determined from these measurements and the saturation parameter was estimated from the gain measurements. Author (GRA)

N72-14523# Army Foreign Science and Technology Center, Charlottesville, Va.
THE PROBLEM OF HEATING OF MATERIAL BY INTENSIVE

ELECTROMAGNETIC RADIATION
Yu. K. Krylov 24 Aug. 1971 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), no. 5, 1968 p 106-112
(AD-729554; FSTC-HT-23-1185-71; T702301-2301) Avail: NTIS CSCL 20/5

A study is performed of the process of heating of a material by a laser beam, considering the actual dependence of the electromagnetic energy flux density on time. An approximate solution is produced allowing the influence of the volumetric absorption of energy to be considered. It is demonstrated that the surface temperature rise rate depends essentially on the pulse form of the stimulating radiation, while the threshold energy causing significant destruction of the material is practically identical for pulses of various forms. Author (GRA)

N72-14524# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
MOLECULAR LASER STUDY, THREE TO FIVE MICRONS Final Report, 1 Aug. 1970 - 31 Jul. 1971
Bernard G. Huth 31 Jul. 1971 64 p refs
(Contract N00014-71-C-0010; ARPA Order 306)
(AD-729693) Avail: NTIS CSCL 20/5

The purpose of this program is to study and further characterize the 8.03 micron laser in an effort to determine the importance of resonant energy transfer from vibrationally excited H2, and to investigate the possibility of obtaining other laser lines from C2H2 in the three to five micron wavelength range. If resonant energy transfer were effective in populating the upper laser level, gases other than acetylene are to be considered. NH3, CH4, and H2O were substituted for C2H2 in the discharge in an effort to find other lasing transitions in the three to five micron range. Author (GRA)

N72-14525# Air Force Cambridge Research Labs., Bedford, Mass.
ATMOSPHERIC ATTENUATION OF CO LASER RADIATION Scientific Interim Report
R. A. McClatchey 1 Jul. 1971 119 p
(AD-729447; AFCRL-71-0370; AFCRL-ERP-359; DoD-Element-62101F; DoD-Subelement-681300) Avail: NTIS CSCL 20/6

With the development of the CO laser having emission lines in the range from 1200/cm to greater than 2000/cm, it is of importance to establish which of the more than 200 lines can be transmitted through a variety of atmospheric paths. The spectral region of CO emission spans a very important water vapor absorption band and, in addition, there is absorption by CO2, O3, N2O and CH4. Absorption lines associated with all of these molecules were included in the calculation of synthetic spectra covering the region of CO emission. After limiting the number of CO emission lines to be considered in detail according to a criterion based on atmospheric attenuation, a series of tables was constructed providing quantitative attenuation information for each of 88 laser lines and for 10 different atmospheric models. Data based on two different aerosol scattering models are included in these tables. Author (GRA)

N72-14526# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
HIGH EFFICIENCY, SINGLE FREQUENCY LASER AND MODULATOR STUDY Semiannual Technical Report, 1 Sep. 1970 - 31 Mar. 1971
Robert C. Ohlmann, W. Culshaw, K. K. Chow, H. V. Hance, W. B. Leonard, and J. Kanneland 30 Apr. 1971 67 p refs
(Contract N00014-71-C-0049; ARPA Order 306)
(AD-730069; LMSC/D179854; Program-Code-42) Avail: NTIS CSCL 20/5

Theoretical and experimental studies on (1) mode filters for single-frequency Nd-YAG lasers, (2) wide-bandwidth optical modulators, and (3) laser communication systems and components are reported. Stable single-frequency output power of 0.2 W is obtained from a Nd-YAG laser by using a combination of tilted etalon and a thin metallic film in the laser cavity. Detailed analyses have been made to reduce the insertion loss of mode filters to an absolute minimum so that efficiency can be increased. The electro-optic modulator uses a microwave interdigital filter structure and has a 1.2-GHz bandwidth. A new circuit design aimed at increasing modulation depth for a given rf power has been obtained. Theory indicates that the interferometric mode of modulation should increase efficiency over the birefringence mode; good experimental agreement has been obtained. Study of optical crystals has been initiated; no optical damage or beam distortion of LiNbO3 was observed under continuous radiation of 14 kW/sq. cm green light when the crystal was at 180C. Several laser communication system concepts and modulation formats have been selected for study. An annotated bibliography of these systems has been published. Author (GRA)

N72-14527# Defense Documentation Center, Alexandria, Va.
GALLIUM LASERS Report Bibliography, Dec. 1963 - Sep. 1970
Aug. 1971 133 p refs
(AD-729820; DDC-TAS-71-38) Avail: NTIS CSCL 20/5

The references in this bibliography have been compiled on Gallium Lasers. The different techniques of lasing have been discussed, and different gallium compound lasers included. Corporate Author-Monitoring Agency, Subject, and Title indexes are included. Author (GRA)

N72-14528# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ISOTOPE SEPARATION WITH THE CW HYDROGEN FLUORIDE LASER
Stanley W. Mayer, Munson A. Kwok, Rolf W. F. Gross, and Donald J. Spencer 8 Sep. 1971 17 p refs
(Contract F04701-71-C-0172)
(AD-729806; TR-0172(9210-02)-1; SAMSO-TR-71-168) Avail: NTIS CSCL 07/5

A CW hydrogen fluoride laser has been used successfully to separate deuterium from hydrogen by specific photocatalysis of the reaction of methanol with bromine. The strong absorption of H3COH was demonstrated for the HF laser lines P1(5), P1(6), and P1(7). No absorption by deutero-methanol of the HF beam was observed. Excitation of H2COH by the absorbed beam increased the rate of H3COH removal by reaction with bromine. Irradiation of a 1:1 H3COH:D3COD gas mixture in the presence of bromine for a period of 1 min with the 90-W CW hydrogen fluoride laser beam produced isotope enrichment to greater than 95 percent D3COD. Author (GRA)

N72-14529# Informatics Tisco, Inc., College Park, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS Interim Report, Jan. - Mar. 1971
Lida L. Allen and Stuart G. Hibben 28 Apr. 1971 57 p
(Contract F44620-70-C-0081; ARPA Order 1622)
(AD-726139; AFOSR-71-1777TR, IR-3) Avail: NTIS CSCL 20/5

Of all material reviewed, the major yield has been from the approximately 300 periodicals which are known to report the most advanced and interesting findings in Soviet laser technology. The period covered the first quarter of 1971, and includes all laser-related articles received by us in that interval. The structure and selection criteria are the same as used in the first report. Somewhat broadened selection criteria have been used for items pertinent to chemical lasers, in view of the expanding possibilities in this technology. Our literature search also reveals an increased emphasis on holographic studies, as well as on uses of stimulated Raman scattering effects in spectroscopy. Other items worthy of mention are two articles on ultraviolet lasers and one on use of an argon ion laser for underwater TV transmission. Author (GRA)

N72-14530# Naval Weapons Center, China Lake, Calif.
A SEARCH FOR SOME WIDE-RANGE TUNABLE DYE LASER SYSTEMS WORKING ON THE EXCIPLEX PRINCIPLE
P. R. Hammond and R. S. Hughes Jun. 1971 18 p refs
(ZR Proj. 011-01)
(AD-730020; NWC-TP-5192; Task-ZR011-01-01) Avail: NTIS CSCL 20/5

The exciplex mechanism of radiation emission from a dye affords one means of producing a broad fluorescent spectrum without adding to the absorption spectrum. It relies on a change of equilibrium properties in the excited state compared with those of the ground state, and the fluorescence is not from the same chemical species absorbing the radiation. Such a system may show a considerable displacement of the fluorescence and absorption spectra so that the threshold input power for lasing may be reduced and the range of tuning can be extended. Also, by a careful selection of conditions, emissions from both the dye and the exciplex may appear, thereby permitting an even greater tuning range. Two mechanisms apply: the proton exciplex, which relates to changes in conventional acidity and basicity in the excited state; and the molecular exciplex, which relates to changes in electron-acceptor and electron-donor properties(i.e., changes in Lewis acidity and basicity). Wide tuning range (blue-violet to yellow-green, 122 nanometers) is reported for 4,8-dimethylumbelliferone. It is proposed that this dye operates by a double proton exciplex mechanism, wherein the molecule is both a stronger acid and a stronger base in the excited state. Peculiarities in the lasing action of 9-aminoacridine are discussed. GRA

N72-14531# Northrop Corporate Labs., Hawthorne, Calif.
KINETIC MODEL AND THEORETICAL CALCULATIONS FOR STEADY STATE ANALYSIS OF ELECTRICALLY EXCITED CO LASER AMPLIFIER SYSTEM Final Report, 1 Aug. 1970 - 31 Jul. 1971
W. B. Lacina Aug. 1971 115 p refs
(Contract N00014-71-C-0037; ARPA Order 306)
(AD-729235; NCL-71-32R) Avail: NTIS CSCL 20/5

A qualitative and quantitative discussion of several aspects of electrically excited CO laser systems is presented. Topics included are molecular spectroscopy and radiative properties, molecular kinetics, and plasma characteristics. Special emphasis is on description of a steady state molecular kinetic model which has been constructed for calculation of the vibrational population distributions and resulting radiative properties for a CO laser amplifier system. The master equation for the vibrational populations is formulated, with several pumping, relaxation, cross-relaxation, and stimulated emission processes included. A computer program for cs operation with an arbitrary number of vibrational levels has been constructed for numerical solution of the master equation, and preliminary results for a variety of parameters are presented. The importance of plasma characteristics is discussed, although calculations for the electron kinetics have not yet been undertaken. Future efforts should be made to analyze the coupled system of electron and molecular kinetics on a consistent and equal basis. Author (GRA)

N72-14532# Informatics Tisco, Inc., Riverdale, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS Interim Report, Jan. 1969 - Jun. 1970
Lida L. Allen 14 Jan. 1971 190 p refs
(Contract F44620-70-C-0081; ARPA Order 1622)
(AD-729888; AFOSR-TR-71-0947) Avail: NTIS CSCL 20/5

The bibliography of Soviet publications on lasers covers the period 1969-1970. Approximately 1500 articles are cited. This output is clear evidence of increased attention to advanced development in such areas as holography, beam-target interactions, high-temperature plasma generation and chemical lasers. Author (GRA)

N72-14533# California Univ., Berkeley.
LASER STUDIES OF ENERGY TRANSFER Final Technical Report
C. Moore 20 Jul. 1971 4 p
(Contract DAHC04-68-C-0044; ARPA Order 675)
(AD-730428; AROD-7692-10-P; Program-Code-9E20) Avail: NTIS CSCL 07/4

The report briefly summarizes research which was divided into two areas. Vibrational energy transfer in CO2 systems and in hydrogen halide systems. GRA

N72-14534# ARO, Inc., Arnold Air Force Station, Tenn.
FREQUENCY BROADENING IN REFERENCE BEAM LASER DOPPLER VELOCIMETER DATA
W. H. Goethert AEDC Sep. 1971 46 p refs
(Contract F40600-72-C-0003; AF Proj. 4344; ARO Proj. BC5019)
(AD-730272; AEDC-TR-71-163) Avail: NTIS CSCL 14/2

The laser Doppler velocimeter (LDV) provides velocity data in the form of a frequency spectrum. Because of the inherent optical geometry of the laser velocimeter and the effects of light scattering particles passing through the probe volume, a frequency distribution density function representing these combined effects is found in the readout device. Hence, interpretation of data must be effected for frequency-to-velocity conversion. This report deals with this frequency broadening effect associated with the LDV reference beam type. Six frequency broadening effects are discussed in terms of their magnitude and relative importance. Author (GRA)

N72-14535# Sanders Associates, Inc., Nashua, N.H. Electro-Optics Div.
SPECTROSCOPIC EVALUATION OF MATERIALS Final Report, 1 Jan. 1968 - 31 Dec. 1970
Evan P. Chicklis, Charles Naiman, and Jack Schwartz 7 May 1971 115 p refs
(Contract F19628-68-C-0162; AF Proj. 5620-08-01)
(AD-729915; AFCRL-71-0378; Rept-5012(BTN)R1; Task-56008; Rept-61102F; Rept-681301) Avail: NTIS CSCL 20/5

The report is divided into two parts. In Part I a non-destructive testing technique is described for the evaluation of damage in ruby laser rods using electron spin resonance. The technique permits examination of ruby rods with conventional ESR techniques without the use of a resonant microwave cavity. Severely damaged rods have been examined with this technique and have conducted controlled damage studies in SIQ rubies before and after comparisons are made. In addition, the range of power densities resulting in measurable damage in the rods are defined. Passively (laser) irradiated ruby samples were also studied using the conventional ESR technique for comparison purposes. In Part II the results of attempts to improve the pumping efficiency of Nd and Er glass laser rods using the diffuse reflectance and fluorescent properties of Cr(3-) doped flame fusion spinel powders are discussed. In addition, the results of detailed spectroscopic studies of the optical properties of flame fusion spinel are discussed. Evidence for the formation of a second site in off stoichiometric MgO:Al2O3 is presented. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-14536 National Lending Library for Science and Technology, Boston Spa (England).
DIFFUSIONLESS TRANSFORMATION IN Ni-Al ALLOYS WITH A LATTICE Cs CHLORIDE
V. S. Litvinov, L. P. Zelenin, and R. S. Shklyar 19 Nov. 1971 7 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved.

(USSR), v. 31, no. 1, Jan. 1971 p 138-142 In ENGLISH and RUSSIAN
(NLL-746-992-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The martensite transformation in Ni-Al alloys with 64, 65, and 66 at.% nickel was investigated. It was shown that one condition of the transformation in these alloys is cooling from a high temperature at such rates that the residual nickel does not precipitate from the lattice of the solid solution. It was established that the transformation of a phase with a bcc lattice into martensite occurs with an increase in volume. The temperature intervals for forward and reverse transformation in the 64% nickel alloy were determined. The martensite which forms has a tetragonal fc lattice, whose parameters depend on nickel content in the solid solution. Author

N72-14537 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF NITROGEN CONTENT IN STAINLESS STEEL
S. F. Khokhlov, T. A. Izmanova, and E. M. Chistyakova 19 Nov. 1971 5 p refs Transl. into ENGLISH from Russian Symposium paper "New Methods of Testing Metals" Moscow, no. 73, 1961 p 125-131 In ENGLISH and RUSSIAN
(NLL-746-900-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The nitrogen content in vacuum melted stainless steel samples was determined in a nickel bath at a dilution of 1:1 with the addition of 2% cerium (total weight of the empty bath and analytical samples) to the bath. Author

N72-14538 National Lending Library for Science and Technology, Boston Spa (England).
OBTAINING OF PROTECTIVE COMPOSITE COATINGS. 1: HEAT RESISTANCE OF DISPERSION-HARDENED Ni
E. Mikailiene and J. Matulis 19 Nov. 1971 15 p refs Transl. into ENGLISH from Liet. TSR Mokslu Akad. Darb., Ser. B (Vilnyus), no. 1, 1971 p 115-122 In ENGLISH and RUSSIAN
(NLL-746-1061-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Coatings of Ni-A1203, Ni-SiO2, Ni-MgO, and Ni-kaolin were electrodeposited and their thermic resistance properties evaluated at 800-1000 C. The metalloceramic coatings were received on Ni basis from electrolytes in which oxides were suspended and imbedded into the deposits during the plating process. Plating conditions and possible maxima of suspended particles in electrolyte were determined. The weight increases of heated specimens containing nickel oxide deposits showed that oxides and kaolin did not indicate an affirmative effect on thermic properties of Ni deposits. It was found that a Cr layer just over a Ni layer improved the temperature resistant properties of coatings. Cr layer thicknesses from 5 to 15 microns trimmed weight increases of heated specimens containing the above mentioned coatings by 2.5-3 times at 900-1000 C. Author

N72-14539 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF ADDITIONS OF 1.4-BUTYNEDIOL ON ELECTRODEPOSITION OF Ni
O. Galdikiene, A. Kargaudiene, and J. Matulis 19 Nov. 1971 8 p refs Transl. into ENGLISH from Liet. TSR Mokslu Akad. Darb., Ser. B. (Vilnyus), no. 1, 1971 p 47-56
(NLL-746-1059-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The effect of 1.4-butynediol on Ni and H2 current efficiency in Ni plating solution as well as copper current efficiency in copper sulphate electrolyte depending on electrolysis conditions have been studied. The influence of addition agent action on cathode layer composition has been investigated. The consumption rate of 1.4-butynediol in processes of Ni electrodeposition and H2 discharge has been determined. The conclusion has been drawn that 1.4-butynediol changes the ratio of the parallel electrode surface reaction rates. The most important factor determining the rate of addition agent change at electrodeposition is the composition and properties of the cathode layer. Author

N72-14540# Royal Inst. of Tech., Stockholm (Sweden).
MAGNETIC AND RESISTIVITY STUDIES IN SOME DILUTE ALLOY SYSTEMS Ph.D. Thesis
Sten G. Humble 1971 109 p refs
Avail: NTIS

The results and findings of magnetic susceptibility and resistivity measurements on Pd, PdH, and Cu-Fe based alloys are presented. The pressure, temperature, and metal working conditions used are given. For individual titles, see N72-14541 through N72-14544.

N72-14541# Royal Inst. of Tech., Stockholm (Sweden).
THE PARAMAGNETIC PROPERTIES OF SOME Pd- AND PdH-BASED ALLOYS IN THE TEMPERATURE REGION 77-300 K
S. G. Humble *In its* Magnetic and Resistivity Studies in Some Dilute Alloy Systems 1971 6 p refs Repr. from Arkiv Fysik (Uppsala), v. 37, no. 41, 1968 p 609-614 (See N72-14540 05-17)
Avail: NTIS

The paramagnetic susceptibilities of some binary and ternary alloys of Pd and PdH with Cr, Mn, and Fe as solutes are investigated. The atomic magnetic moments and the values of the Weiss' theta were determined from the measurements and could in some cases be compared with data obtained by Gerstenberg and Burger et al. in their investigations of a number of binary Pd-transition metal alloys. Author

N72-14542# Royal Inst. of Tech., Stockholm (Sweden).
A STUDY OF THE ELECTRICAL RESISTIVITY OF SOME DILUTE Pd- AND PdH-BASED ALLOYS AT NORMAL AND HIGH PRESSURES
S. G. Humble and J. O. Linde *In its* Magnetic and Resistivity Studies in Some Dilute Alloy Systems 1971 6 p refs Repr. from Arkiv Fysik (Uppsala), v. 37, no. 39, 1968 p 595-600 (See N72-14540 05-17)
Avail: NTIS

The electrical properties of Pd binary alloys with Fe, Mn, or Cr as solutes as well as these alloys saturated with hydrogen, are examined. The results of atomic resistivity data obtained at 20 C for the binary and hydrogenized alloys are given in tables and graphs. E.H.W.

N72-14543# Royal Inst. of Tech., Stockholm (Sweden).
SOME MAGNETIC AND RESISTIVITY MEASUREMENTS ON DILUTE Cu-Fe ALLOYS IN DIFFERENT STATES OF ANNEALING AND COLD-WORKING IN THE TEMPERATURE RANGE 1.7 - 350 K
S. G. Humble and K. Svensson *In its* Magnetic and Resistivity Studies in Some Dilute Alloy Systems 1971 75 p refs Submitted for publication (See N72-14540 05-17)
Avail: NTIS

The effects of cold working and annealing on the magnetic susceptibility and resistivity of Cu-Fe alloys in the concentration range 0.1 to 2.4 at. % are measured. The measurements were made at temperatures between 90 and 350 K and, in some cases at 1.7 K. Results are given in graphical form. E.H.W.

N72-14544# Royal Inst. of Tech., Stockholm (Sweden).
EFFECTS OF COLD-WORKING AND ANNEALING ON THE RESISTIVITY MINIMUM OF SOME DILUTE Cu-Fe ALLOYS
S. G. Humble, K. Svensson, and H. U. Astrom *In its* Magnetic and Resistivity Studies in Some Dilute Alloy Systems 1971 2 p refs Repr. from Phys. Scr. (Stockholm), v. 1, 1970 p 151-152 (See N72-14540 05-17)
Avail: NTIS

Changes in the temperature at which the resistivity minimum occurs were studied in dilute Cu-Fe alloys in different quenched,

cold worked, and annealed states. The effects observed are thought to be caused by clustering tendencies of the iron atoms in the matrix affecting the scattering process. The connection between the temperature of the resistivity minimum and the Fe concentration empirically derived by Knook for very dilute Cu-Fe alloys is shown to hold reasonably well for quenched alloys at Fe concentrations below about 0.85 at. % while for alloys of higher concentrations the temperature of the resistivity minimum decreases with increasing Fe content. In the latter case intense cold work is shown to cause an increase of the temperature of the resistivity minimum whereas annealing processes lower the same temperature. Author

N72-14545# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.

EFFECT OF SPRAYBOND COATING ON THE TENSION-TENSION FATIGUE PROPERTIES OF AISI 4340 STEEL

Joseph Viglione and Walter F. Worden 18 May 1971 16 p refs

(AD-729290; NADC-MA-7119) Avail: NTIS CSCL 11/6

An investigation was conducted to determine the effects of the flame sprayed molydenum Spraybond coating on the tension-tension fatigue properties of 4340 steel at the 240 - 260 ksi strength level. Because of the harmful overheating inherent in the Spraybond process, the original 255 ksi tensile strength level of the coated specimens was reduced to approximately 180 ksi. Some tests were conducted at the reduced strength level (overheated specimens) and an increase in fatigue life was noted for the unpeened and peened specimens, as compared to the life of the bare tempered control specimens (180 ksi). However, the validity of the results were in question, since establishing the actual strength level of each coated specimen would have required destructive tests, which was obviously impossible. It is important to emphasize the need for avoiding incidental harmful overheating of steel parts when applying Spraybond or any other flame sprayed metallic coating for 'build-up' of worn or undersized components, particularly when components are small in size, and fatigue and retention of tensile strength are critical considerations. Author (GRA)

N72-14546*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CRACK TOUGHNESS EVALUATION OF HOT PRESSED AND FORGED BERYLLIUM

M. H. Jones, R. T. Bubsey, and W. F. Brown, Jr. 1971 40 p refs Presented at Am. Soc. for Testing Mater. Comm. on Fracture Testing of Beryllium, Cleveland, 8-9 Dec. 1971

(NASA-TM-X-67967; E-6681) Avail: NTIS CSCL 11F

Beryllium fracture toughness test specimens were fatigue cracked using reversed cycling with a compression load two to three times the tension load. In worked beryllium, textures may be produced which result in fatigue cracks that are out of plane with the starter notch. Specimens of hot pressed stock exhibited load displacement records which were nonlinear throughout their course. Fracture specimens of both hot pressed and forged stock showed essentially no reduction of thickness and the fracture surfaces were flat and normal to the load axis. However, the stress intensity factor at maximum load increased with decreasing thickness. Load-displacement and electric potential records for the hot pressed beryllium specimens exhibited several anomalies such as negative residual crack mouth displacements and a decrease in electrical potential with increasing load. Author

N72-14547*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF SOME CANDIDATE MATERIALS FOR AUTOMOBILE THERMAL REACTORS IN ENGINE-DYNAMOMETER SCREENING TESTS Interim Report

Robert E. Oldrieve Dec. 1971 29 p refs

(NASA-TM-X-67970; E-6684) Avail: NTIS CSCL 11F

Fourteen materials were evaluated in engine screening tests on full-size thermal reactors for automobile engine pollution control systems. Cyclic test-stand engine operation provided 2 hours at 1040 C and a 20-minute air-cool to 70 C each test cycle. Each reactor material was exposed to 83 cycles in 200 hours of engine testing. On the basis of resistance to oxidation and distortion, the best materials included two ferritic iron alloys (Ge 1541 and Armco 18S/R), several commercial oxidation-resistant coatings on AISI 651 (19-9 DL), and possibly uncoated AISI 310. The best commercial coatings were Cr-Al, Ni-Cr, and a glass ceramic. Author

N72-14548*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OXIDATION/VAPORIZATION OF SILICIDE COATED COLUMBIUM BASE ALLOYS

Fred J. Kohl and Carl A. Stearns Dec. 1971 52 p refs

(NASA-TM-X-67980; E-6704) Avail: NTIS CSCL 11F

Mass spectrometric and target collection experiments were made at 1600 K to elucidate the mode of oxidative vaporization of two columbium alloys, fused-slurry-coated with a complex silicide former (Si-20Cr-Fe). At oxygen pressures up to 0.0005 torr the major vapor component detected by mass spectrometry for oxidized samples was gaseous silicon monoxide. Analysis of condensates collected at oxygen pressures of 0.1, 1.0 and 10 torr revealed that chromium-, silicon-, iron- and tungsten-containing species were the major products of vaporization. Equilibrium thermochemical diagrams were constructed for the metal-oxygen system corresponding to each constituent metal in both the coating and base alloy. The major vaporizing species are expected to be the gaseous oxides of chromium, silicon, iron and tungsten. Plots of vapor phase composition and maximum vaporization rate versus oxygen pressure were calculated for each coating constituent. The major contribution to weight loss by vaporization at oxygen pressures above 1 torr was shown to be the chromium-containing species. Author

N72-14549*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPLORATORY SCREENING TESTS OF SEVERAL ALLOYS AND COATINGS FOR AUTOMOBILE THERMAL REACTORS

Robert E. Oldrieve Dec. 1971 30 p refs

(NASA-TM-X-67984; E-6717) Avail: NTIS CSCL 11F

A total of 23 materials (including uncoated ferritic and austenitic iron-base alloys, uncoated nickel and cobalt-base superalloys, and several different coatings on AISI 304 stainless steel) were screened as test coupons on a rack in an automobile thermal reactor. Test exposures were generally 51 hours including 142 thermal cycles of 10 minutes at 1010 + or - 30 C test coupon temperature and 7-minutes cool-down to about 510 C. Materials that exhibited corrosion resistance better than that of Hastelloy X include: a ferritic iron alloy with 6 weight percent aluminum; three nickel-base superalloys; two diffused-aluminum coatings on AISI 304; and a Ni-Cr slurry-sprayed coating on AISI 304. Preliminary comparison is made on the performance of the directly impinged coupons and a reactor core of the same material. Author

N72-14550*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REVIEW OF DEFORMATION BEHAVIOR OF TUNGSTEN AT TEMPERATURE LESS THAN 0.2 ABSOLUTE MELTING TEMPERATURE

Joseph R. Stephens Washington Jan. 1972 32 p refs

(NASA-TM-X-2482; E-6500) Avail: NTIS CSCL 11F

The deformation behavior of tungsten at temperatures $< 0.2\ T_m$ is reviewed, with primary emphasis on the temperature dependence of the yield stress and the ductile-brittle transition temperature. It appears that a model based on the high Peierls stress of tungsten best accounts for the observed mechanical behavior at low temperatures. Recent research is discussed which suggests an important role of electron concentration and bonding on the mechanical behavior of tungsten. It is concluded that future research on tungsten should include studies to define more clearly the correlation between electron concentration and mechanical behavior of tungsten alloys and other transition metal alloys. Author

N72-14551*# Little (Arthur D.), Inc., Cambridge, Mass.
BASIC FACTORS CONTROLLING PEST IN HIGH TEMPERATURE SYSTEMS Final Report
J. Berkowitz-Mattuck and M. Rossetti 20 Nov. 1971 30 p refs
(Contract NASw-1887)
(NASA-CR-125071) Avail: NTIS CSCL 11F

The catastrophic disintegration in air at intermediate temperatures of refractory materials which are very resistant to oxidation at high temperatures is known as pest. A study was undertaken to determine whether the mechanism proposed for pest failure in silicides might also be responsible for pest failure in NbAl3. The aim was to correlate oxidation kinetics in the range where disintegration of NbAl3 is observed with delayed failure data obtained under similar conditions. Studies were also undertaken to develop some understanding of deformation mechanisms in both silicides and aluminides. Author

N72-14552*# Translation Consultants, Ltd., Arlington, Va.
LOCAL STEEL ANALYSIS USING THE LMA-1 MICROANALYZER
V. Janosikova and M. Tomasova Washington NASA Jan. 1972 15 p refs Transl. into ENGLISH from Hutnicke Listy (Prague), v. 26, no. 5, 1971 p 359-364
(Contract NASw-2038)
(NASA-TT-F-14038) Avail: NTIS CSCL 11F

A microanalysis technique, based on the use of a pulsed Nd laser (LMA-1) with a power output of 100 millijoules and microscope focussing, is used to detect > or = 10 to the minus 9th power to 10 to the minus 10th power grams Mn, Si, Cr, Ni, Mo, and V in steels with accuracies similar to those attained in spark discharge analysis, even through the sample volume vaporized was much smaller (diameter = 20 to 140 microns). The method was used to detect local Cr contents of 18.15 and 17.63% with standard deviations of 0.0470 and 0.0227, respectively, in austenite and ppt. enriched austenite, respectively. Author

N72-14553# Aeronautical Research Labs., Melbourne (Australia).
THE TRANSITION PHASE ETA IN Al-Zn-Mg ALLOYS
J. H Auld and S. McK. Cousland Jun. 1971 18 p refs
(ARL/Met-74) Avail: NTIS

The X-ray diffraction techniques were used to study the transition phase eta in Al-Zn-Mg alloys. A hexagonal unit cell with a =4.89A,C=13.74A was required to index all the observed reflections. The advantage of X-ray diffraction techniques, especially the precession method, over electron diffraction techniques is pointed out. Author

N72-14554# National Lead Co. of Ohio, Cincinnati.
INFLUENCE OF THERMAL CYCLING ON THE MICROSTRUCTURES OF URANIUM-BASE DILUTE SILICON AND ALUMINUM ALLOYS Annual Report, Jul. 1967 - Jun. 1968
F. N. Rhines Jun. 1971 57 p refs
(Contract AT(30-1)-1156)
(NLCO-1064) Avail: NTIS

Uranium-base dilute alloys in which silicon additions dominate, exhibit microstructural activity which is characterized by continuous recrystallization during thermal cycling. The resultant grain boundary sweeping causes boundaries to detach from pores and pore growth to diminish. Uranium-base dilute alloys in which aluminum dominates, exhibit microstructural activity characterized by twin boundary sweeping, thus accounting for boundary detachment from pores and reduced pore growth. Results of laser heating experiments showed that surface cracks can be nucleated both on grain and twin boundaries.
Author (NSA)

N72-14555# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PRODUCTION OF VOIDS IN PURE METALS BY HIGH ENERGY HEAVY ION BOMBARDMENT
G. L. Kulcinski, J. L. Brimhall, and H. E. Kissinger [1971] 50 p refs Presented at the Intern. Conf. on Radiation Induced Voids in Metals, Albany, 9 Jun. 1971 Sponsored by AEC
(BNWL-SA-3966; Conf-710601-8) Avail: NTIS

The mechanisms by which heavy ions produce defects in metals are reviewed and some of the major differences in specific damage rates between electrons, neutrons, light ions, and heavy ions are discussed. Recent experimental information of the fluence dependence of the formation of voids in nickel and the temperature dependence of void formation in Mo, TZM, and Nb are given. The effect of pre-injected helium on the formation of voids in nickel is also discussed. Author (NSA)

N72-14556# Commissariat a l'Energie Atomique, Bruyeres-Le-Chatel (France). Centre d'Etudes.
MICROGRAPHIC STUDIES OF TWO WEAKLY CHARGED URANIUM ALLOYS RUPTURED AT VARIOUS TEMPERATURES
Jeanne Legrand and Michele Caput Apr. 1971 26 p refs In FRENCH
(CEA-R-4140) Avail: AEC Depository Libraries

Micrographic studies of uranium alloys showed that the mode of rupture was modified when the temperature exceeded about 100 C and that they generally became ductile. Either small hollows or large planar zones corresponding to large plastic deformation were observed. At high temperatures (500 to 600 C) very particular properties were observed which may be attributed to the onset of recrystallization at the grain boundaries. Author (NSA)

N72-14557# McElroy (Ralph) Co., Austin, Tex.
PROCESS FOR THE PREPARATION OF TANTALUM AND/OR NIOBIUM METAL BY REDUCTION OF TANTALUM AND/OR NIOBIUM PENTACHLORIDE WITH HYDROGEN
Walter Scheller, Claude Beguin, and Klaus Schuett [1971] 7 p Transl. into ENGLISH from the German Patent 1,295,194 Prepared for Los Alamos Scientific Lab.
(LA-tr-71-35) Avail: NTIS

A process is described for the preparation of tantalum and/or niobium metal by the reduction of tantalum and/or niobium pentachloride with hydrogen. The chloride or the chloride mixture is introduced into a hydrogen plasma and the reduction is carried out in the presence of a condensed material with a particle size of less than 500 microns, preferably a powdered metal, a heavy metal carbide or oxide, and that the contract time of the dispersed material amounts to 01. to .0004 seconds. The metals are obtained in very pure form and no deposits of the separated metal are formed on the walls of the reduction vessel, but rather the metals are deposited in a powdery or granular form. NSA

N72-14558# Iowa Univ., Iowa City. Dept. of Mechanical Engineering.
CYCLIC YIELD BEHAVIOR OF TANTALUM
David R. Helebrant and Ralph I. Stephens Aug. 1971 26 p refs
(Contract DAAF03-69-C-0014)
(AD-728837; THEMIS-UI-34) Avail: NTIS CSCL 11/6

Previous investigations have shown the room temperature upper yield point stress of b.c.c. iron, molybdenum and niobium can be completely removed by initially 'elastic' fully-reversed cyclic stressing above the fatigue limit. The research described shows the upper yield point stress in tantalum can also be removed under these same conditions and is dependent upon the stress amplitude and the number of applied stress cycles. Aging at room temperature did not cause a return of the upper yield point. The cyclic stress-strain curve of tantalum cyclically strain softened at small strain amplitudes and cyclically strain hardened at larger amplitudes. Under constant cyclic strain amplitudes in the inelastic region, tantalum exhibited slight initial cyclic strain hardening. The cyclic yield point behavior is

explained in terms of localized cumulative multiplication of mobile dislocations. Author (GRA)

N72-14559# Iowa Univ., Iowa City. Dept. of Mechanical Engineering.
INELASTIC CYCLIC INSTABILITY OF 2024-T4 ALUMINUM AND COLD-ROLLED 1020 STEEL
C. R. Pischmann and R. I. Stephens Jul. 1971 33 p refs
(Contract DAAF03-69-C-0014; Proj. Themis)
(AD-728838; THEMIS-UI-33) Avail: NTIS CSCL 11/6

An investigation was made into the cyclic instabilities of cyclic strain hardening and cyclic strain softening materials. 2024-T4 aluminum and cold-rolled 1020 steel were selected respectively. Specimens had fixed ends with a slenderness ratio l/r equal to 40 and were cycled at .1 to .5 Hz. Under axial fully reversed constant load amplitude conditions, the cyclically strain softening steel became unstable at approximately two thirds the monotonic buckling stress. This decrease was attributed primarily to decreases in the tangent modulus, however tensile strain ratchetting also had an influence. For aluminum under the same loading conditions, cyclic instabilities and monotonic instabilities occurred at essentially the same stress level. Under fully reversed strain conditions with aluminum, slight increases in stress levels at initial bifurcation occurred when cycling was begun with compression first. Aluminum specimens used to determine the cyclic stress-strain curve also had slightly increased stress at initial bifurcation compared to monotonic values.
Author (GRA)

N72-14560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY OF THE THERMAL CONDUCTIVITY COEFFICIENT AND THE INTEGRAL LEVEL OF BLACKNESS OF REFRACTORY METALS AT TEMPERATURES HIGHER THAN 1000 C
D. L. Timrot, V. E. Peletskii, and V. Yu. Voskresenskii 26 Jun. 1971 19 p refs Transl. into ENGLISH from Teplofizicheskie Svoistva Tverdykh Tel pri Vysokykh Temperaturakh, Vsesoyuznoe Konf. po Teplofizicheskim Svoistvam Veshchestv pri Vysokykh Temperaturakh, Novosibirsk, 25-30 Jul. 1966
(AD-729081; FSTC-HT-23-751-71) Avail: NTIS CSCL 11/6

The article describes the instrument and procedures used in calculating the thermal conductivity coefficient and the level of blackness of refractory metals, especially poly - and monocrystalline molybdenum. GRA

N72-14561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INTERACTION OF MOLYBDENUM WITH NITROGEN AND THE EFFECT OF NITRIDING ON THE PROPERTIES OF MOLYBDENUM ALLOYS
Ya. D. Kogan 25 Jun. 1971 20 p refs Transl. into ENGLISH from Khimiko-Termicheskaya Obrabotka Stali i Splavov (USSR), no. 6, 1969 p 28-40
(AF Proj. 7343)
(AD-729038; FTD-MT-24-43-71) Avail: NTIS CSCL 11/6

The nitriding of molybdenum in an ammonia medium leads to the formation of diffusion nitride layers, the thickness of which depending on the temperature (up to 1130 degrees centigrade) obeys exponential law, and depending on the duration of the process - to parabolic law. The alloying of molybdenum with titanium, zirconium and carbon accelerates the diffusion of nitrogen. Nitriding considerably raises the surface microhardness, wear resistance and heat resistance of molybdenum. An optimum condition of nitriding of sheet molybdenum 1-1.5 mm thickness for increase in heat resistance in nitriding at 900-1000 degrees centigrade for 1 hr; for the increase in wear resistance - 1000 degrees centigrade for 3 hrs. Nitriding is accompanied by increase in the temperature threshold of brittleness, however for prescribed technological condition of saturation, which allows the obtaining of satisfactory plasticity at room temperature and considerable increase in heat resistance at temperatures 1000-1400 degrees centigrade. Author (GRA)

N72-14562# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
A COMPARISON OF VARIOUS TEST METHODS FOR DETECTING HYDROGEN EMBRITTLEMENT Progress Report
E. J. Jankowsky 8 Jun. 1971 17 p refs
(AD-726165; NADC-MA-7066; Task-A320-5203/202-B/1)
Avail: NTIS CSCL 11/6

Four hydrogen embrittlement test methods were evaluated using three paint strippers as the embrittling media. Results were compared with those obtained with notched C-rings, the method now prescribed in paint stripper specifications. In general, all the methods give good results and good correlation. The main differences were in ease of use. Author (GRA)

N72-14563# Naval Research Lab., Washington, D.C.
THE ELECTROCHEMICAL CHARACTERISTICS OF ALUMINUM GALVANIC-ANODE ALLOYS IN SEAWATER Interim Progress Report
T. J. Lennox, Jr., R. E. Groover, and M. H. Peterson Jun. 1971 39 p refs
(SF Proj. 51-542-602-12431; RR Proj. 007-08-44-5510)
(AD-729252; NRL-MR-2300; IPR-10) Avail: NTIS CSCL 11/6

Aluminum anodes have a theoretical ampere-hour-per-pound capacity approximately two and one-half times that obtained from magnesium anodes and approximately three and one-half times that obtained from zinc anodes. The actual current capacities in seawater, however, are determined by the electrochemical efficiency of the individual aluminum anode alloy. The electrochemical characteristics of several types of aluminum anodes under similar service conditions are discussed in the report and are compared to similar data obtained from zinc anodes and from aluminum anodes reported previously. Aluminum anodes containing mercury-zinc have consistently demonstrated current capacities in excess of 1250 ampere hours per pound. Under some exposure conditions large sections of these anodes might be lost before attaining their complete useful service-life. The indium-zinc aluminum anodes have a minimum current capacity of 757 ampere hours per pound. When operated at nominal in-service anode current density levels, other electrochemical characteristics were essentially equivalent to those of the zinc control anode. None of the tin-zinc aluminum anodes which apparently require a proprietary heat treatment for improved electrochemical characteristics had consistently high current capacities. It was also evident from this study that even commercial-size aluminum anodes in short-term experiments at high current densities do not predict the true long-term electrochemical characteristics in seawater. Author (GRA)

N72-14564# Physics International Co., San Leandro, Calif.
MATERIAL PROPERTIES MEASUREMENTS USING PULSED ELECTRON BEAMS Final Report
Tibor Stefansky, Aldo Mazzella, Kenneth Triebes, and James Shea Jul. 1971 128 p refs
(Contract DAAG46-69-C-0126; DA Proj. 1T0-62105-A-331)
(AD-729364; PIFR-174; AMMRC-CR-71-9) Avail: NTIS CSCL 14/2

A technique was developed for measuring the elevated-temperature tensile properties of materials following 'instantaneous' in-depth heating. High-energy pulsed electron beams are used to heat specimens to the required temperature in approximately 0.08 microsec, and a Hopkinson bar-type device, in a tensile configuration, is used to perform the mechanical tests at any desired time after irradiation. Data on the temperature-induced degradation of the Young's Modulus and the yield stress of 2014-T6 aluminum and commercially pure alpha titanium was obtained. The data extend up to approximately 700 F for three different times at temperature: 0.2 msec, 1.0 msec and 10 msec. The results indicate that the Young's Modulus at ambient pressure appears to be a function of temperature only. The degradation of the yield strength is time- and temperature-dependent but not as severe as that shown by the long-heating-time and book data. Author (GRA)

N72-14565# Naval Research Lab., Washington, D.C.
COMPARISON OF PLANE-STRESS FRACTURE TOUGHNESS FOR THREE ALUMINUM SHEET ALLOYS Final Report
Charles N. Freed, Anna M. Sullivan, and Joseph Stoop 11 Aug. 1971 12 p refs
(RR Proj. 007-01-46-5431; NRL Proj. M01-24)
(AD-729641; NRL-7299) Avail: NTIS CSCL 11/6

A program for evolving analytical procedures to characterize the fracture resistance of high-strength sheet metals has been initiated. The first phase of this program is concerned with the development of a standard plane-stress test method for reliable characterization of high-strength sheet alloys. The test incorporates fracture mechanics principles to define the relationship between the stress and critical crack size at instability in terms of a single parameter. A center-cracked sheet panel has been selected as the most promising test-specimen configuration to investigate this relationship.
Author (GRA)

N72-14566# Naval Research Lab., Washington, D.C. Interim Report
THE FLOW STRENGTH DEPENDENCE ON TEMPERATURE AND STRAIN RATE IN LOW CARBON IRON ALLOYS
A. R. Cox and L. R. Hettche 4 Aug. 1971 37 p refs
(NRL Proj. RR009-03-45-5450)
(AD-729648; NRL-7283; NRL-Probl-F01-03A) Avail: NTIS CSCL 11/6

The flow strengths of a series of iron-carbon alloys, containing silicon, manganese, nickel, and phosphorus, were measured over the strain-rate range 0.001 to 10/sec. At 24C all four elements reduced the strain-rate sensitivity of the base alloy (0.02 wt-% C) but, with the exception of the combined addition of silicon and manganese, had little effect at -195 C. At a strain rate of 2/sec, the thermal component of the strength was reduced by the alloying elements. This reduction was sufficient in the carbon, nickel, and phosphorus alloys to make their total strength less than that of the unalloyed iron at some temperatures. These results are discussed in terms of the current solution-softening models.
Author (GRA)

N72-14567# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh. Nuclear Research Centre.
HYDROGEN BEHAVIOR IN METALS USING NUCLEAR MAGNETIC RESONANCE Final Scientific Report, Mar. 1966 - Nov. 1970
David Zamir and Charles Korn Nov. 1970 145 p refs
(Contract AF 61(052)-904)
(AD-729690) Avail: NTIS CSCL 11/6

Parameters considered important for the explanation of hydrogen embrittlement of titanium and its alloys have been measured using NMR techniques. The proton spin lattice relaxation time T(1) has been measured by the pulse technique at 19.00 MHz as a function of temperature in the range 25-500 C for a series of samples in the alpha, beta, gamma phases of titanium hydride. The diffusional activation energy was found to be constant with respect to the hydrogen concentration. The activation energy behavior and jump attempt frequency is discussed in relation to a harmonic oscillator potential well derived from neutron inelastic scattering experiments and from this study. The conduction electron contribution to the relaxation mechanism increased with hydrogen concentration, indicating an increase in energy density of states at the Fermi level. Hydrogen in titanium aluminum alloys was found to exist in two different crystallographic environments, one diffusing faster than the other. The hydride system is probably based on the Ti2Al structure and the possible location of hydrogen in the lattice is discussed. X-ray measurements on hydrogen free Ti3Al and Ti3Al containing hydrogen giving an H/Ti ratio of 1.3, showed extreme distortion to the lattice upon hydrogen absorption. The X-ray diffraction lines for the hydride could not be resolved.
Author (GRA)

N72-14568# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTIVE COATINGS ON METALS NO. 3: SELECTED ARTICLES
23 Jul. 1971 34 p Transl. into ENGLISH from Zashchitn. Pokrytiya na Metallakh. (USSR), no. 3, 1970 p 223-240
(AD-730078; FTD-HC-23-386-71; DIA-Task-T68-01-02) Avail: NTIS CSCL 11/3

Contents: The surface alloying of the alloy ZhS6K using three elements; Certain results derived from testing and study of compacted heat-resistant coatings; The structure and properties of heat-resistant alloys with vacuum diffusion coatings. GRA

N72-14569# Army Construction Engineering Research Lab., Champaign, Ill.
FEASIBILITY OF PRODUCING DIRECTIONALLY TRANSFORMED MARTENSITE IN STEEL Preliminary Report
Robert Quattrone and C. Marvin Wayman Jun. 1971 16 p refs
(AD-729660; CERL-PR-M-7) Avail: NTIS CSCL 11/6

The feasibility of and possible techniques for strengthening steel by using directional martensite are explored in this report. On the basis of an analysis of the austenite to martensite transformation, it appears that martensite can be oriented if (a) its parent, austenite, can first be oriented and (b) the activity of habit planes can be controlled. It is believed that the first of these can be accomplished by forming deformation and/or annealing textures, and the second, by using a martensite morphology with a low habit plane multiplicity and straining in a specific crystallographic direction during transformation. Steels strengthened by this technique may obtain ultra-high strength and stiffness by a mechanism similar to fiber reinforcement. Applications for such a material include high-strength wires, protective construction and site hardening, and light-weight armor.
Author (GRA)

N72-14570# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FATIGUE CRACK GROWTH BEHAVIOR OF A HIGH STRENGTH STEEL Technical Report, Mar. - Nov. 1970
Maurice F. Amateau and Ernest G. Kendall 15 Sep. 1971 89 p refs
(Contract F04701-71-C-0172)
(AD-729807; TR-0172(2250-10)-1; SAMSO-TR-71-186) Avail: NTIS CSCL 11/6

Fatigue crack growth behavior of high-strength Ladish D6AC steel was examined under various conditions of frequency, environment, temperature, stress ratio, and stress intensity history. Materials with fracture toughness ranging from 50 to 100 ksi/sq. in., but with the same yield strength of 220 ksi, were examined. Variations in fracture toughness do not have a strong effect on crack growth rate at stress intensity levels within the log-linear portion of the crack growth curves. Different environments, such as dry air, laboratory air, and distilled water, were found to produce different fatigue crack growth behavior at 1 Hz but not at 10 Hz loading frequency. The lowest crack growth rate occurred in dry air, while the aggressive environment of distilled water affected the crack growth rate more severely at lower stress intensity levels. The effects of temperature over the range from -40 to 175F are a uniform shift of the growth curve to low crack growth rates and a lowering of the stress intensity level for the onset of rapid fatigue crack propagation. Suppression of crack growth rate following high prior stress cycles is the most significant effect of stress history. This effect cannot be explained in terms of the relative plastic zone sizes alone.
Author (GRA)

N72-14571# Army Foreign Science and Technology Center, Charlottesville, Va.
FATIGUE STRENGTH OF ALLOY Kh15N70V7M3T2YuR IN THE TEMPERATURE RANGE 500-850 C AFTER MECHANICAL AND ELECTROCHEMICAL POLISHING
V. V. Zhukov and A. N. Sintsev 25 Aug. 1971 10 p refs

Transl. into ENGLISH from Aviats. Inst., Tr. (Kazan), no. 112, 1969 p 103-108
(AD-729864; FSTC-HT-23-500-71; T702301-2301; J-9789) Avail: NTIS CSCL 11/6

A comparative study of fatigue strength of the industrial alloy Kh15N70V7M3T2YuR was conducted on specimens with electrochernical and mechanical polishing under temperatures of 500, 700, 800, and 850C. It was found that the surface strain hardening associated with mechanical polishing increases the fatigue limit of this alloy at temperatures below 750C and decreases this limit above 750C. GRA

N72-14572# Army Foreign Science and Technology Center, Charlottesville, Va.
PLASTICITY OF THE ALLOY 50 at. PERCENT Bi-50 at. PERCENT Sn IN EXTENSION AT HIGH PRESSURE
L. D. Livshits, B. P. Beresnev, and Yu. N. Ryabinin 29 Jul. 1971 11 p refs Transl. into ENGLISH from Plastichnost Splava 50 at. percent Bi-50 at. percent Bi-50 at. Sn pri Rastyazhenii pod Vysokim Davleniem, Dokl. Akad. Nauk SSSR (Moscow), v. 161, no. 5, 1965 p 1077-1080
(FSTC Proj. T702)
(AD-729090; FSTC-HT-23-1013-71) Avail: NTIS CSCL 11/6

Experiments are performed at room temperature involving extension of the alloy mentioned at high hydrostatic pressure, revealing a new phenomenon: the existence of intervals of pressure in which the material may have increased or decreased plasticity. It is assumed that the singular mechanical properties in these pressure intervals are related to peculiarities in the p-t diagram of the alloy. GRA

N72-14573# General Motors Technical Center, Warren, Mich. Materials and Structures Lab.
MEASUREMENTS OF DYNAMIC PROPERTIES OF MATERIALS. VOLUME 5: OFHC COPPER Final Report
Douglas R. Christman, William M. Isbell, and Stephen G. Babcock Jul. 1971 110 p refs
(Contract DASA01-68-C-0114)
(AD-728846; MSL-70-23-Vol-5; DASA-2501-5-Vol-5; Subtask-AA106) Avail: NTIS CSCL 11/6

Results of an experimental study on the dynamic properties of OFHC copper (1/2-hard) are presented. Areas studied included stress-strain-strain rate and reverse loading behavior, elastic constants, equation of state, compressive and release wave characteristics, and spall fracture. The material showed approximately elastic-perfectly plastic behavior under uniaxial stress compression with slight rate sensitivity (0.005 to 950/sec strain rates and 20,204 and 370C). Longitudinal and shear wave velocities at 20C were 4.757 and 2.247 mm/microsec, and temperature and pressure dependence was also measured and various elastic constants were calculated. The shock wave equation of state (EOS) was measured from 10 to 200 kbars. The EOS was also calculated from the elastic constants and comparisons made with the shock wave EOS. Compressive wave tests showed a ramped, non-steady-state elastic precursor with very rapid decay (= 80% in 2 mm). The yield level from compressive wave profile measurements was considerably lower than that determined from uniaxial stress and EOS tests. Shock wave profiles showing both release wave behavior and attenuation were obtained. The impact velocity required for spall fracture was found to increase with decreasing pulse width.
Author (GRA)

N72-14574# Naval Research Lab., Washington, D.C. Physical Metallurgy Branch.
MARINE CORROSION STUDIES: THE EFFECTS OF Cu2O ANTIFOULING PAINT AND COUPLING TO A COPPER ALLOY ON THE CORROSION RESISTANCE OF 6Al-4V TITANIUM ALLOY IN SEAWATER Interim Progress Report
T. J. Lennox, Jr., M. H. Peterson, and R. E. Groover Jul. 1971 17 p refs
(NRL Proj. SF51-542-602-124)
(AD-730436; NRL-MR-2333; IPR-11; NRL-Probl-Mo4-02) Avail: NTIS CSCL 11/6

The 6Al-4V titanium alloy exhibited the expected excellent corrosion resistance in quiescent seawater; coating it with Cu2O-type antifouling paint or coupling to yellow brass had no deleterious effects on the titanium. The yellow brass, however, was subject to severe dealloying which was not completely eliminated by cathodic protection from a zinc anode.
Author (GRA)

N72-14575# Picatinny Arsenal, Dover, N.J. Mechanical Inspection Equipment Branch.
INFRARED SCANNING TO DETECT IMPROPERLY SEATED ROTATING BANDS ON THE 105 MM ROCKET ASSISTANCE PROJECTILE Final Report
Robert E. Lee and Jay S. Pasman Jul. 1971 41 p ref
(AD-729930; PA-TM-2016; AMS-Code-4931.0M.6350.1.03) Avail: NTIS CSCL 19/1

A program was undertaken to determine if nondestructive infrared scanning techniques could be applied to the inspection of sintered iron rotating bands for adequate seating on the 105mm Rocket assisted projectile (XM548 and XM566). The standard seating deformation test cannot be used on sintered metal. Under the sponsorship of the Army Materials and Mechanics Research Center a method was developed which successfully identified all defective bands in an especially prepared batch of twenty bodies. The feasibility of rapid and automated inspection has been demonstrated, permitting up to one hundred percent production line testing. Author (GRA)

N72-14576# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
THE EFFECT OF PRIOR DEFORMATION ON THE STRENGTH AND ANNEALING OF REVERTED AUSTENITE
Theodore J. Koppenaal and Edward Gold 17 Sep. 1971 33 p refs
(Contract N00014-70-C-0223)
(AD-730137; TR-2) Avail: NTIS CSCL 11/6

The strength, annealing behavior, and microstructure of reverted austenite has been measured in an FE-31%Ni-.03%C alloy that was plastically deformed prior to the reversion to austenite. Mechanical properties of reverted austenite (e.g., austenite formed by the reverse martensite shear transformation) were measured as a function of the amount of prior deformation, heating and cooling rates to the reversion temperature, austenitizing temperature and time, repetitive cycling from martensite to reverted austenite, and pre-reversion heat treatments. The results showed that 80% prior deformation increases the yield strength of reverted austenite about 30%. Along with this strengthening, the dislocation configuration changes from a random array of tangled dislocations in reverted samples without prior deformation to a subgrain structure with a high density of tangled dislocations within the subgrains in samples with 80% deformation prior to reversion. Although smaller amounts of prior deformation (20%) have only a small effect on the strength of the reverted austenite, this amount of prior deformation significantly increases the driving force for recrystallization. The results are explained on the basis that the prior deformation and the reversion process produce separate components to the strength and annealing behavior.
Author (GRA)

N72-14577# Naval Research Lab., Washington, D.C. Strength of Metals Branch.
FRACTURE EXTENSION RESISTANCE (R CURVE) CONCEPTS FOR FRACTURE-SAFE DESIGN WITH NONFRANGIBLE TITANIUM ALLOYS
R. W. Judy, Jr. and R. J. Goode 16 Aug. 1971 25 p refs
(RR Proj. 007-01-46-5432)
(AD-730440; NRL-7313) Avail: NTIS CSCL 11/6

New procedures were evolved to characterize the fracture extension resistance of nonfrangible structural titanium alloys. Fracture extension resistance is defined by the increase in plastic work energy required to propagate a crack. The

parameter is the R-curve slope of the metal. Characteristic R-curve features are presented for titanium alloys ranging from frangible to high fracture toughness types. The R-curve slope determines the plastic work energy expended for fracture extension in structures, as confirmed by Explosion Tear Test results. The R curves are defined by the use of the Dynamic Tear test specimen. Indexing the R-curve slopes to the Ratio Analysis Diagram (RAD) for titanium provides definition of the metal capabilities for use in structures of low, intermediate, and high compliance features. This integration of structural aspects with the mechanical and metallurgical aspects of the RAD should provide for significant advances in generalized fracture-safe design of titanium structures raising nonfrangible alloys.
Author (GRA)

N72-14578# Connecticut Univ., Storrs. Inst. of Materials Science.
STRUCTURAL FATIGUE Annual Report, Jun. 1970 - Jun. 1971
A. J. McEvily, Jr. 1 Jun. 1971 44 p refs
(Contract F44620-69-C-0011; AF Proj. 9560)
(AD-729965; UC-MET-6-71; AFOSR-71-2420TR; Rept-611-2F; Rept-681307) Avail: NTIS CSCL 11/6

The report covers the June 1970-June 1971 period of research into structure fatigue under a Project Themis grant at the University of Connecticut. During this period research has been conducted in the areas of fracture mechanics and mechanisms, environmental influences on fatigue, dislocation behavior, alloy preparation, the use of X-ray diffraction in fatigue, and in non-destructive testing. Specific highlights of the past year's program are detailed herein as well as plans for future studies to be carried out in this research program. Author (GRA)

N72-14579# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE PROCEEDINGS OF THE SEMINAR PHYSICS AND CHEMISTRY OF THE TREATMENT OF MATERIALS BY CONCENTRATED ENERGY FLOWS
A. A. Uglov 12 Jul. 1971 12 p Transl. into ENGLISH from Fiz Khim. Obrabotki Materialov (USSR), no. 5, 1967 p 133-135
(FTD Proj. 7JJ)
(AD-729963; FTD-HT-23-792-71; DIA-Task-T66-01-8) Avail: NTIS CSCL 11/6

The report is on the eighth seminar (July 27 and 28, 1967) at the Metallurgical Institute Im. A. A. Baykov Acad. Sci. SSSR. Thermophysical processes under action of pulsed sources of energy on solids were discussed. GRA

N72-14580# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ONE DIMENSIONAL TRANSIENT TEMPERATURE AND STRESS DISTRIBUTIONS PRODUCED IN A 0.0625 INCH THICK 7075 A-T6 FLAT PLATE BY FOURTEEN NUCLEAR THERMAL ENVIRONMENTS
Ennis F. Quigley Jun. 1971 35 p refs
(AD-730309; BRL-MR-2100) Avail: NTIS CSCL 11/6

Using CINDA-3G, a three-dimensional, multi-mode heat transfer computer program, the one-dimensional transient temperature distributions produced in a 0.0625 inch thick, 7075AL-T6 flat plate when the plate's front surface is exposed to each of fourteen different nuclear thermal radiation environments were calculated. The transient compression stress distributions required to keep the plate from expanding in two mutually perpendicular directions were also calculated. If all of the radiant energy incident on the surface is absorbed, five of the fourteen environments provide enough energy to produce a change of phase in the plate. For the remaining nine environments, compression stresses ranging from 13,500 psi to 132,000 psi would be required to keep the plate from expanding.
Author (GRA)

N72-14581# California Univ., Los Angeles. Materials Dept.
THE USE OF PRE-CRACKED CHARPY SPECIMENS TO DETERMINE DYNAMIC FRACTURE TOUGHNESS
W. L. Server and Alan S. Tetelman Jul. 1971 28 p refs
(Contract DAHC04-69-C-0008; DA Proj. 2o0-61102-B-32-D)
(AD-730678; UCLA-ENG-7153; AROD-8016-5-MC; TR-6) Avail: NTIS CSCL 11/6

The use of an instrumented impact hammer on pre-cracked Charpy V specimens has led to an inexpensive method for determining the dynamic fracture toughness, K sub Id. Measurements were made on A-533 steel over a range of temperature (-125 to -75F) at a loading rate K clot approximately equal to 1,000,000 ksi (in. to the 1/2 power)/sec. The data were found to be in excellent agreement with those obtained by other workers on much larger specimens. Analysis of the data leads to a new method for estimating the NDT temperature, which may be of practical value in nuclear reactor surveillance programs. Author (GRA)

N72-14582# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.
MAGNETIC BEHAVIOR OF NICKEL AND NICKEL-COPPER ALLOYS NEAR THE CRITICAL POINT
Elmer E. Anderson, Sigurds Arajs, A. A. Stelmaca, and B. L. Tehan 1 Sep. 1971 42 p refs
(Contract N00014-70-A-0311-0001)
(AD-730354; TR-1-71) Avail: NTIS CSCL 11/6

The critical exponent beta, which describes the behavior of the magnetization near the critical point, has been studied for pure nickel and for nickel alloys containing 4.6, 9.3, 14.0, and 18.8 at. % copper. Within experimental error the value of beta equal to 0.34 was obtained for all of these samples. The double values for beta previously reported are shown to arise from an erroneous critical temperature when resulting from the linear extrapolation technique of Wojtowicz and Rayl. Author (GRA)

N72-14583# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROSLAG MELTING
Yu. V. Latash and B. I. Medovar 28 Jun. 1971 168 p refs
Transl. into ENGLISH of the publ. "Elektroshlakovyy Pereplay" Moscow, Izd-vo Met., 1970 p 1-239
(FTD Proj. 60108)
(AD-730371; FTD-MT-24-16-71; DIA-Task-T65-01-82; DIA-Task-T65-01-83) Avail: NTIS CSCL 11/6

The book deals with a method of producing steels and alloys of especially high quality. The history of the creation of the method is described, extensive material concerning investigation of melting and crystallization of metals is included, as well as discussion of the physicochemical processes occurring during electroslag remelting of consumable electroslag in a cooled mold. Data are given on the quality of electroslag metal and on the economic effectiveness of the method. New developments in the field of electroslag remelting of metal are described.
Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-14584# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
PROTECTIVE FINISHING SYSTEMS FOR MAGNESIUM AIRCRAFT COMPONENTS Phase Report
Stanley R. Brown 7 Jul. 1971 97 p refs
(AD-729651; NADC-MA-7102) Avail: NTIS CSCL 11/3

Evaluations of magnesium finishing systems were made to select surface treatments and topcoats for rework and repair of naval aircraft parts. Corrosion resistance of finishes for the power section was determined on QE 22A-T6 magnesium alloy cyclically exposed to 5% NaCl salt spray and 400F. Magnesium airframe part finishes were evaluated after immersion testing in a NaCl solution. MIL-M-45202B, Type II Dow 17 anodize exhibited high corrosion resistance with several topcoat systems. A lesser degree of protection has been selected around which the interface requirements have been described. Author (GRA)

N72-14585*# Boeing Co., Seattle, Wash.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF AIRCRAFT METAL STRUCTURES REINFORCED WITH FILAMENTARY COMPOSITES. PHASE 1: CONCEPT DEVELOPMENT AND FEASIBILITY
S. Oken and R. R. June Washington NASA Dec. 1971 129 p refs
(Contract NAS1-8858)
(NASA-CR-1859) Avail: NTIS CSCL 11D

The analytical and experimental investigations are described in the first phase of a program to establish the feasibility of reinforcing metal aircraft structures with advanced filamentary composites. The interactions resulting from combining the two types of materials into single assemblies as well as their ability to function structurally were studied. The combinations studied were boron-epoxy reinforced aluminum, boron-epoxy reinforced titanium, and boron-polyimide reinforced titanium. The concepts used unidirectional composites as reinforcement in the primary loading direction and metal for carrying the transverse loads as well as its portion of the primary load. The program established that several realistic concepts could be fabricated, that these concepts could perform to a level that would result in significant weight savings, and that there are means for predicting their capability within a reasonable degree of accuracy. This program also encountered problems related to the application of polyimide systems that resulted in their relatively poor and variable performance. Author

N72-14586*# Israel Program for Scientific Translations, Ltd., Jerusalem.
FIBROUS COMPOSITES
I. N. Frantsevich and D. M. Karpinos, eds. 1972 393 p refs Transl. into ENGLISH of the book "Kompozitsionnye Materialy Voloknistogo Stroeniya" Kiev, Izdatelstvo Naukova Dumka, 1970 Sponsored jointly by NASA and NSF
(NASA-TT-F-675; TT-71-50050; IPST-CAT-5980; ISBN-0-7065-1226-X) Avail: NTIS HC $6.00/MF $0.95 CSCL 11D

Research in materials for aircraft and rocket engineering is reported. Equations are presented for calculating the strength, elastic and rheonomic properties, thermal conductivity, and diffusion processes of composite fibers. Principles of reinforcing, and the strength properties of materials reinforced by continuous and discrete fibers are discussed. The effect of thermal stresses on the strength characteristics, a statistical model of fracture, and defects and fracturing of composites are described. Technological processes in the production of metallic and ceramic fibers, and their physicomechanical properties are reviewed. Reinforced materials based on plastics, porous fibrous materials, the production of metallic and nonmetallic reinforcing elements, and metallic materials with a fibrous structure obtained by crystallization and other heat treatments are also discussed. Author

N72-14587*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMALLY STABLE POLYIMIDES FROM SOLUTIONS OF MONOMERIC REACTANTS
Tito T. Serafini, Peter Delvigs, and George R. Lightsey Washington Jan. 1972 13 p refs
(NASA-TN-D-6611; E-6255) Avail: NTIS CSCL 11D

A method for preparing thermally stable resin-fiber-reinforced composites by using solutions of appropriate monomers is described. Solutions containing a dimethyl ester of an aryl tetracarboxylic acid, the monomethyl ester of nadic acid, and an aryl diamine were used to impregnate graphite fibers. Composites fabricated from these prepregs exhibited excellent thermo-oxidative stability and retention of mechanical properties at 315 C (600 F). These results compare favorably to those obtained from composites made from amide-acid prepolymers capped with reactive alicyclic rings. Monomeric solutions provide excellent shelf life and improved solubility compared to amide-acid prepolymer solutions. Author

N72-14588*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIELECTRIC BREAKDOWN IN A DILUTE PLASMA: A 20 KILOVOLT LIMITED STUDY
Daniel J. McKinzie, Jr. and Norman T. Grier Washington Jan. 1972 13 p refs
(NASA-TM-X-2444; E-6568) Avail: NTIS CSCL 20I

A dielectric breakdown study was made of several materials proposed for high-voltage (16-kV) use on solar-cell arrays at space conditions. The tests were made in an argon plasma whose electron density and temperature approximately simulated conditions at an altitude of 300 km. The maximum voltage used was 20 kV. The results indicate that the breakdown voltages of the materials tested are larger than those quoted in the literature for dielectric between two metal electrodes. Author

N72-14589*# Translation Consultants, Ltd., Arlington, Va.
THE TOXICITY OF PLASTICIZERS USED IN PROCESSING PLASTICS
T. Wexler Washington NASA Oct. 1971 7 p refs Transl. into ENGLISH from Materiale Plast., (Bucharest), v. 7, no. 9, 1969-1970 p 478-4-79
(Contract NASw-2038)
(NASA-TT-F-13882) Avail: NTIS CSCL 11I

An annotated list of some of the major plasticizers used in processing plastic wraps for food from a toxicological point of view is presented. Author

N72-14590*# Techtran Corp., Glen Burnie, Md.
IDENTIFICATION OF PLASTICIZERS IN PLASTICS BY THIN-LAYER CHROMATOGRAPHY
Malgorzata Swiatecka and Halina Zowall Washington NASA Oct. 1971 7 p refs Transl. into ENGLISH from Polimery (Warsaw), v. 14, no. 4, 1969 p 165-166
(Contract NASw-2037)
(NASA-TT-F-13883) Avail: NTIS CSCL 11I

A method is described for identifying four sets of plasticizers used in commercial plastics manufacture through chromatography practiced upon a thin layer of an extract of these substances. Author

N72-14591*# Translation Consultants, Ltd., Arlington, Va.
DETERMINING THE GELATION PROPERTIES OF PLASTICIZERS USING THE BRABENDER PLASTOGRAPH
E. Stern and B. Wolf Washington NASA Oct. 1971 10 p refs Transl. into ENGLISH from Materiale Plast. (Bucharest), v. 5, no. 3, 1968 p 87-89
(Contract NASw-2038)
(NASA-TT-F-13881) Avail: NTIS CSCL 11I

A new procedure for determining the gelation and stability properties of plasticizers, under conditions approximating real processing conditions, is described. The Brabender plastograph was used to estimate the gelation behavior of several plasticized PVC mixtures. A characteristic curve for the bonding due to the viscosity of the melted material as a function of the time is given for a plasticized PVC mixture. The effect of various factors upon the gelation properties of PVC plasticizer mixtures is illustrated. Author

N72-14592*# Stanford Research Inst., Menlo Park, Calif.
INDUCTION PLASMA CALCINING OF PIGMENT PARTICLES FOR THERMAL CONTROL COATINGS Interim Technical Report, 1 Apr. 1970 - 31 Jan. 1971
E. P. Farley 5 Feb. 1971 31 p refs
(Contract NAS8-21270)
(NASA-CR-121063; ITR-4) Avail: NTIS CSCL 11C

Induction plasma heating techniques were studied for calcining zinc orthotitanate particles for use in thermal control coatings. Previous studies indicated that the optimum calcining temperature is between 1400 and 1750 C. An intermediate temperature (1670 C) was chosen as a reference point for running a temperature series at the reference point and 220 C on both sides. The effect of varying chamber temperature on the reflectance spectra, before and after vacuum UV irradiation, is presented. The correlation between Zn2Ti04 paramagnetic resonance activity and its susceptibility to vacuum UV damage is discussed. F.O.S.

N72-14593*# Ohio State Univ. Research Foundation, Columbus.
PREPARATION OF PIGMENTS FOR SPACE-STABLE THERMAL CONTROL COATINGS Interim Report, Sep. 1970 - Jan. 1971
W. B. Campbell, S. G. Nychas, and R. G. Smith Feb. 1971 42 p refs
(Contract NAS8-21317)
(NASA-CR-121061) Avail: NTIS CSCL 11C

Calculations of mixing conditions in the vapor reaction system established criteria for reactor design. Gas mixing was optimized by jet action and vapor phase production of zinc orthotitanate has been accomplished. Author

N72-14594# Joint Publications Research Service, Washington, D.C.
SYNTHESIS, PROPERTIES, AND NATURE OF THE ACTIVE SEGMENTS OF NEURISTOR-LIKE ELEMENTS DERIVED FROM CHALCOGENIDE MATERIALS
S. A. Kutolin, V. P. Kotenko, A. Ye Shammasova, and L. F. Belova 7 Jan. 1972 13 p refs Transl. into ENGLISH from Elektron. Tekhn. (Moscow), v. 7, no. 1, 1971 p 64-72
(JPRS-54879; UDC-542.91; CSO-0575/72-W) Avail: NTIS

Synthetic results and physicochemical, optical, and electrophysical properties as well as characteristics are presented for the chalcogenide materials containing from 6.0 to 5.5 electrons/atom. Materials of this type constitute the active part of neuristor-like elements and possess bonds with covalent character. A correlation is demonstrated between the synthetic method, the physicochemical properties of the chalcogenide groups under study, and the performance of functional devices fabricated from them. Author

N72-14595# Royal Aircraft Establishment, Farnborough (England).
TENSILE TESTS ON LAP-JOINTS IN CARBON FIBRE REINFORCED PLASTICS
J. B. Sturgeon Aug. 1970 28 p refs
(RAE-TR-70159; UDC-661.66-426:620.172.2) Avail: NTIS

Results are presented for lap-joints tested in tension for adherends of type 1 and type 2 CFRP (carbon fiber reinforced plastics) and also for type 1 treated carbon fiber laminates with glass scrim cloth facings. The percentage of the unjointed composite load realized in the jointed specimens was sometimes higher than 50% indicating that this type of joint could be suitable for joining CFRP to itself. Author (ESRO)

N72-14596# Research Inst. of National Defence, Stockholm (Sweden).
STRESS AND DEFORMATION IN CIRCULAR ROTOR DISCS MADE FROM AN ANISOTROPIC MATERIAL
Gunnar Florin Jun. 1971 14 p refs
(PB-200869; FOA-2-B2027-91) Avail: NTIS; HC FOA P, 104 50, Stockholm 80, Sweden Kr 3 CSCL 11I

Primarily in view of their high specific strength and the possibility of obtaining, within certain limitations, tailor-made material properties, fiber-reinforced plastics (FRP) have great attraction as rotor materials. These composite materials have anisotropic properties as a consequence of the way in which they are made up, which can have a very great effect on the states of stress and deformation, particularly in rotor disks with a plane middle surface. In order to bring about optimal placing of the reinforcement in these, it is therefore important to study theoretically the influence on the stresses and deformations in the disks of geometry, distribution of density, and material parameters. Such a theoretical study which deals mainly with elastic conditions associated with short-term loading is described. Author (GRA)

N72-14597# Army Foreign Science and Technology Center, Charlottesville, Va.
METHODS OF EVALUATING THE PHYSICAL PROPERTIES OF A CELLULOSE SHEET
A. P. Sivkova and D. I. Mandelbaum 9 Jun. 1971 12 p refs Transl. into ENGLISH from Khim. Volokna (USSR), v. 11, no. 5, 1969 p 73-75
(AD-728707; FSTC-HT-23-536-71) Avail: NTIS CSCL 07/1

Experiments were conducted in order to choose objective methods for determining the physical properties of a cellulose sheet. Author (GRA)

N72-14598# Army Foreign Science and Technology Center, Charlottesville, Va.
THE EFFECT OF STRESS ON THE NATURE OF THE BREAKDOWN OF TRANSPARENT POLYMERS BY LASER LIGHT
G. V. Plyatsko, Ya. S. Podstrigach, and V. M. Zhirovetskii Aug. 1971 11 p refs Transl. into ENGLISH from Fiz.-Khim. Mekh. Mater. (Kiev), v. 5, no. 4, 1969 p 493-496
(AD-729584; FSTC-HT-23-433-71; T702301-2301; ACSI-J-9471) Avail: NTIS CSCL 11/9

Both isotropic and anisotropic elements of stress participate in the breakdown process of transparent polymers. The primary breakdown of the material by laser light is determined by the action of the main expansion stresses. Author (GRA)

N72-14599# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
A 3200 ANGSTROM PHOSPHOR Final Report, 1 Jul. 1968 - 30 Apr. 1971
Jon W. Ogland, Edward C. Malarkey, and Michael R. Natale Jul. 1971 72 p refs
(Contract DAAB07-68-C-0392; DA Proj. 1H6-22001-A-055)
(AD-729368; ECOM-0392-F; FR-8) Avail: NTIS CSCL 11/7

The objective of the program was to conduct a research and development program leading to the production of a cathodoluminescent phosphor which emits with high efficiency in the spectral region around 3200 A and to incorporate the developed phosphor into very high resolution cathode-ray tubes with fiber optic faceplates for data recording on UV sensitive, dry-process film. The work during the final reporting period is summarized and the results of all the 3200 A phosphor development work are reviewed. The design of the very high resolution CRT's is described. Author (GRA)

N72-14600# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md.
INFRARED REFLECTANCE SPECTRA FOR SELECTED PAINT PIGMENTS Final Report
Merrill L. Cohen and John P. Doner Jul. 1971 106 p
(DA Proj. 1T0-62105-A-329)
(AD-729354; CCL-293; AMCMS-Code-502E.11.295000) Avail: NTIS CSCL 11/3

The report presents data on the near infrared reflectance spectra, 0.6-2.0 micron region, for 89 pigments in a wide range of colors. Pigments, both organic and inorganic, were selected

for low infrared absorption and possible use in the design of military coatings with controlled infrared reflectance. The data obtained provides a basis for characterization of the pigments examined based on reflectance properties. Author (GRA)

N72-14601# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
EXPERIMENTAL DEMONSTRATION OF A VISCOELASTIC CROSSOVER PHENOMENON. THE REFLECTION OF STRESS PULSES AT THE BOUNDARY BETWEEN NEARLY ELASTIC AND LOSSY VISCOELASTIC MEDIA WHOSE IMPEDANCES ARE MATCHED
Mark B. Moffett May 1971 68 p refs
(Contracts DA-31-124-ARO(D)-358)
(AD-729823; AROD-5606-15-E; TR-18) Avail: NTIS CSCL 11/9

Observations were made of the longitudinal stress pulses reflected from an interface between two viscoelastic rods. The incident medium (polystyrene) was nearly elastic, while the reflecting medium (unplasticized polyvinyl chloride) was fairly lossy, having a frequency-dependent, complex extensional-wave impedance. The frequency at which the impedances of the two materials are equal in magnitude is termed the 'crossover' frequency and is temperature-dependent. Fourier components well above the crossover frequency are reflected substantially in phase, while those well below this frequency are reflected nearly out of phase. By varying the temperature, and hence the crossover frequency, the reflected pulses were made to vary from essentially-positive at room temperature to essentially-negative at 55C. At an intermediate temperature, the reflected pulse had a minimum amplitude and a shape significantly different from that of the incident pulse (this case is the viscoelastic analog of impedance matching for elastic media). The experimental results serve to demonstrate the viscoelastic-crossover effect predicted by Kolsky and Lee. Author (GRA)

N72-14602# Missouri Univ., Rolla. Dept. of Ceramic Engineering.
HIGH TEMPERATURE IR GLASSES Technical Report, 1 Sep. 1969 - 31 Aug. 1971
Norbert J. Kreidl 31 Aug. 1971 42 p refs
(Contract N00014-69-A-0141-0003; Nr Proj. 039-105)
(AD-729676; TR-1; Rept-1-0003) Avail: NTIS CSCL 11/2

Fields of glass formation, crystalline phases in these fields, ranges of immiscibility, and the relation of composition as well as heat treatment to the glass temperature in selected chalcogenide glass systems were investigated. The main objective of the investigation was to acquire knowledge for the development of glasses having a higher softening range than industrial chalcogenide glass window materials while maintaining their infrared transmittance. In the field Ge-Sb-Se, in which the industrial glass Ge28Sb12Se60 occurs, the softening temperature was maximized with promising excursions into quaternaries such as those with B and As. The investigation was extended into the field Si-As-Te which has not been exploited industrially because glasses invariably exhibited oxygen infrared absorption bands. High softening range glasses were registered, including some quaternary derivatives, in the hope for later elimination of the oxygen band by more sophisticated product and process control. A facility for preparing pure reproducible chalcogenide glass samples was designed, constructed, and operated successfully. Author (GRA)

N72-14603# Southwest Research Inst., San Antonio, Tex.
PREPARATION OF CAPSULES Final Report, 1 Aug. 1970 - 31 Jul. 1971
Leon M. Adams 9 Sep. 1971 8 p
(Contract N00014-71-C-0027; NR Proj. 356-509; SwRI proj. 01-2928-01)
(AD-729691) Avail: NTIS CSCL 13/8

A government-furnished material was successfully encapsulated, and a number of small vials of the resulting capsules were supplied to the Office of Naval Research for testing. The best capsule shell formulation evaluated was predominantly poly(vinyl alcohol). Author (GRA)

N72-14604# Army Foreign Science and Technology Center, Charlottesville, Va.
PREDICTING THE DURABILITY OF POLYMER COATINGS
E. A. Kanevskaya, I. V. Elisavetskaya, and P. I. Zubov 25 Aug. 1971 14 p refs Transl. into ENGLISH from Lakokrasoch. Mater. i Ikh Primen. (Moscow), no. 2, 1969 p 51-53
(AD-729483; FSTC-HT-23-505-71; T702301-2301; J-9810)
Avail: NTIS CSCL 11/3

An attempt was made in this work to establish a quantitative criterion for forecasting the durability of coatings under full-scale conditions on the basis of accelerated test results. The conversion factor K between accelerated and full-scale tests is defined. The relation between durability and the protective properties of many groups of paints and varnishes during tests under full-scale conditions and by accelerated methods is given. It is shown that the durability of paint and varnish coatings determined by means of the relations derived herein coincides with the experimentally determined durability. Author (GRA)

N72-14605# Boeing Co., Kent, Wash. Aerospace Group.
ADHESIVE PROPERTY PHENOMENA AND TEST TECHNIQUES Final Report, Mar. 1970 - Jun. 1971
Ronald F. Zabora, William W. Clinton, and James E. Bell
Wright-Patterson AFB, Ohio AFFDL Jul. 1971 161 p refs
(Contract F33615-70-C-1292; AF Proj. 4364)
(AD-729873; AFFDL-TR-71-68) Avail: NTIS CSCL 13/5

Test techniques were developed to determine adhesive properties in tension and shear. The test techniques combined a Tuckerman optical strain gage with a Physitech optical tracker to provide a recording sensitivity of 10 to the -6 with a Physitech optical tracker to provide a recording sensitivity of 10 to the -6 inches displacement with strain rate control and continuous recording capability. Three different adhesives were tested to demonstrate the suitability of the test techniques for use on all adhesives. The effects of bond thickness, bond width, strain rate, and adherent material on adhesive properties were investigated. Biaxial tests were performed on one adhesive. Test data show bond thickness, strain rate and the scrim material in supported adhesives produce significant effects on adhesive behavior. Adherent material and bond width did not affect shear properties but did affect tension properties of adhesives. This was attributed to constraining of the adhesive by the adherend. Additional research is required to completely define the effect of adhesive constraint. A Ramberg-Osgood relation was found to describe the stress-strain behavior of adhesives. Two distinct shape factors were observed for all three adhesives. A modified form of the Ramberg-Osgood equation can be employed to describe strain rate effects on adhesive properties. It was concluded that the suitability and usefulness of the test techniques developed were amply demonstrated. The incorporation of these techniques in adhesive specifications and their use to study processing effects is recommended. Author (GRA)

N72-14606# TRW Systems Group, Redondo Beach, Calif.
HOLOGRAPHIC CHARACTERIZATION OF CERAMICS. PART 2: OBSERVATION OF STATIC FATIGUE Final Report, 15 May 1970 - 15 Jun. 1971
Terry V. Roszhart and Jack R. Bohn 15 Jul. 1971 42 p refs
(Contract N00019-70-C-0136)
(AD-729699) Avail: NTIS CSCL 11/2

An experiment is described which uses live fringe holographic interferometry to observe static fatigue in glass. A characteristic holographic fringe pattern has been observed which indicates the existence and location of minute flaws propagating in a glass specimen subjected to a constant load. The fringe pattern is observed continuously as the crack propagates through the material thereby permitting detection of impending failure as much as 20 minutes prior to spontaneous fracture. The results of the experiments demonstrate that live fringe holographic interferometry offers the investigator a new technique for the detection, observation, and control of flaw growth in brittle materials. Due to the complexity of rigorous fringe analysis and the lack of a usable mathematical model for deflections caused by a crack in a bending beam, the results of these experiments

are discussed in a semi-quantitative fashion. The ability of holographic interferometry to obtain both qualitative and quantitative data coupled with the highly coherent pulsed ruby laser system discussed in Part I of this program could permit the application of these techniques to design oriented failure problems as well as theoretical fracture studies. Author (GRA)

N72-14607# Oklahoma Univ., Norman
DRAG CHARACTERISTICS FOR A COMPLIANT SURFACE AIRFOIL Ph.D. Thesis
Humphrey H. Chu 1971 114 p refs
(Contract DA-31-124-ARO(D)-349; DA Proj. 2-0-061102-B-33-G)
(AD-729921; AROD-5596-10-E) Avail: NTIS CSCL 11/3

As part of a program to investigate the feasibility of reducing aerodynamic skin-friction drag by the use of compliant coatings, a detailed wind-tunnel study was made to determine the drag characteristics of a compliant coating on an airfoil. The compliant surface was constructed with different thicknesses (0.001 to 0.025 inch) of polyvinyl-chloride (PVC) membrane backed by a 3/16 to 6/16 inch damping layer of polyurethane foam (40 PPI). The foam was bonded to specially designed airfoils to form NACA 0009 airfoils. Hard surface NACA 0009 airfoils were also constructed. A reduction of skin friction drag was recorded in order to be sure the drag reduction did not come from the shifting of the transition line, both experimental (china-clay) and theoretical (von-Karman-Pohlhausen) methods were used to determine the transition point. Author (GRA)

N72-14608# Duke Univ., Durham, N.C. Dept. of Electrical Engineering.
STUDY OF THIN FILM DIELECTRICS AND INSULATORS FOR CRYOGENIC APPLICATIONS Final Report, Feb. 1970 - Jul. 1971
John L. Artley and Jake H. Halford Aug. 1971 84 p refs
(Contract DAAK02-70-C-0110)
(AD-730757) Avail: NTIS CSCL 11/7

The report presents the results of experimental investigations into the use of thin film dielectric materials silicon oxide and bismuth trioxide in cryogenic applications. Particular attention is given to the use of SiO with zirconium. Thin film capacitors of Zr-SiO-Zr were deposited and tested at temperatures from 300K to 4.2K. Results indicate that there is an interaction between zirconium and SiO films. Effective, useful capacitors were deposited and tested with dielectric thicknesses of 4000A. A new method of vacuum deposition of Zr utilizing electron bombardment is reported. Thermal cycling of a Pb-SiO thin film solenoid indicates that large areas of thin film devices are more susceptible to peeling when going from room temperature to the temperature of liquid helium. Nonlinear volt-ampere characteristics are reported from bismuth trioxide thin film dielectrics when used with gold electrodes. Author (GRA)

N72-14609# Pennsylvania Univ., Philadelphia.
THEORY OF HETEROGENEOUS, ANISOTROPIC, AND RANDOM MEDIA Final Report, 4 Mar. 1964 - 31 Aug. 1971
Zvi Hashin 1971 9 p refs
(Contract DA-31-124-ARO(D)-194; DA Proj. 200-61104-B-33-G)
(AD-730784; AROD-4753-13-E) Avail: NTIS CSCL 11/4

The purpose of this research was to conduct investigations of mechanical and physical behavior of composite materials, heterogenous media and anisotropic media. The purpose of the work carried out was twofold: to further our basic scientific understanding of problems in this broad area and to provide the engineer with better knowledge of the properties of composite materials, which are of foremost practical prominence. In the report, achievements and results obtained are discussed in order of classification by areas of interest. Author (GRA)

N72-14610# Watervliet Arsenal, N.Y. Benet R and E Labs.
EFFECT OF MODULUS RATIO ON STRESS NEAR A DISCONTINUOUS FIBER
Thomas F. MacLaughlin and R. M. Barker (Va. Polytechnic Inst.) May 1971 30 p refs
(DA Proj. 1T062105-A-349)
(AD-730677; WVT-7130) Avail: NTIS CSCL 11/4

The effect of the fiber to matrix modulus of elasticity ratio varying from 1.0 to 200 was investigated for a two-dimensional plane stress composite configuration having a simulated fiber volume fraction of 0.45 and containing a discontinuous fiber. Uniaxial loading parallel to the fibers was considered. Two independent techniques were used; moire strain analysis, and finite element analysis. Displacements were measured from four experimental models by utilizing optical fringe multiplication techniques. The finite element method yielded stresses which agreed closely with those obtained from the experimental analysis. Matrix stress concentration factor near the discontinuous fiber was found to increase rapidly with increasing modulus ratio, reaching a value of 20 for a modulus ratio of 200. The finite element method was shown to be a valuable tool for micromechanical stress analysis of composite materials, and the accuracy of strain analysis by moire fringe multiplication techniques was demonstrated for problems containing severe strain gradients. Author (GRA)

N72-14611# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
EVALUATION OF COATINGS FOR DRAGON GAS GENERATOR APPLICATION
Ellis R. Parker Jun. 1971 36 p
(DA Proj. 1X5-23627-D-306)
(AD-730666; RL-TR-71-7) Avail: NTIS CSCL 11/3

Maraging steel panels were coated with finishes of paint per MIL-P-23377, vacuum-deposited aluminum, vacuum-deposited cadmium, flame-sprayed aluminum, and electroless nickel, and were exposed to 1200 hours of salt spray and humidity testing. In addition, tests were conducted to determine reaction effects between the paint coating and the HEN-12 propellant. The vacuum cadmium and paint coatings performed best in protecting the maraging steel panels. The reaction effects between the paint coating and HEN-12 propellant were considered negligible. Author (GRA)

N72-14612# National Cash Register Co., Dayton, Ohio. Capsular Products Products Research and Development.
DEVELOPMENT OF MULTIPURPOSE CAPSULAR ADHESIVE SYSTEMS Final Report
Gavin H. Peters, Carl K. Schaab, Ronald D. Hilbelink, and Terry R. Davis May 1971 60 p refs
(Contract DAAA21-68-C-0581)
(AD-730908; PA-TR-4215) Avail: NTIS CSCL 11/1

A unique, polyester-epoxy adhesive system was developed which cures very rapidly upon mixing of its two components and adheres to a multitude of substrates under various environmental conditions. Each of the two liquid adhesive components can be encapsulated to form pseudo solids. Mixing together of the two capsular components into the proper ratio forms a stable, one can, dry powder adhesive that is easily activated upon rupture of the capsules. This rapid curing capsular adhesive system, with its improved stability, handling and logistics characteristics due to encapsulation, was further characterized during the second phase of the program. Capsular adhesive stability was found to be nine months under laboratory conditions with the epoxy component being the limiting factor. Several formulation variations were made that affected cure time, bond strength and adhesion properties. Encapsulation of each of the two components was easily scaled up through the pilot-plant stage. Several mechanical adhesive applicator designs were developed and evaluated for the extrusion and application of both the capsular adhesives and the same formulations in their liquid, unencapsulated forms. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-14613 Polytechnic Inst. of Brooklyn, N.Y.
A SECOND ORDER ACCURATE METHOD FOR THE SOLUTION OF THE TWO-DIMENSIONAL UNSTEADY COMPRESSIBLE NAVIER-STOKES EQUATIONS Ph.D. Thesis
Dominic Joseph Palumbo 1970 68 p
Avail: Univ. Microfilms Order No. 70-26089

A second order accurate difference scheme is presented for the calculation of two-dimensional, viscous, compressible flows. The unsteady Navier-Stokes equations are used with the assumptions of a thermally and calorically perfect gas. The coefficients of viscosity and heat conductivity are taken to be functions of the temperature. A derivation of the scheme and a linear stability analysis are presented. The accuracy of the scheme is determined by comparing a numerical calculation to the known analytic solution for a one-dimensional shock transition. The scheme is used to compute the flow field over a flat plate having finite thickness for a Mach number of 2.0 and a Reynolds number of 10. The problem is solved in three separate regions becaused of the large computer storage required. After the flow field on the windward side of the plate is obtained the leeward or wake region is calculated. These two regions are then coupled for the final calculation. Dissert. Abstr.

N72-14614 University of Southern Calif., Los Angeles.
NONLINEAR CONTROLLABILITY AND INVOLUTORY ACTUATOR ORBITS Ph.D. Thesis
Alexander Chen-Che Liang 1970 78 p
Avail: Univ. Microfilms Order No. 71-2529

The general multidimensional linear optimal control problem with quadratic cost functional and nonquadratic weighting on the final states is completely solved in closed form by utilizing Caratheodory's construction of C to the second power solutions to the Hamilton-Jacobi equation associated with the control problem. The same method is also applied to a broad spectrum on nonlinear control processes with nonquadratic cost functionals. The idea of involutory actuator orbits is introduced. A class of nonlinear control processes with involutory actuator orbits is shown to have an equivalent class of linear systems with nonquadratic cost functionals. Dissert. Abstr.

N72-14615 Washington Univ., Seattle.
THE HARMONIC FINITE ELEMENT MODEL FOR USE IN FIELD PROBLEMS Ph.D. Thesis
Guenther Johannes Schmid 1970 109 p
Avail: Univ. Microfilms Order No. 71-1023

A dual formulation to the compatible finite element method is presented to aid in solving boundary value problems which arise in many areas of mathematical physics. The compatible and the dual harmonic approaches are described as extensions to the Ritz and Trefftz methods. For two- and three-dimensional problems, harmonic models with a constant gradient of the scalar field inside the element were derived. For two-dimensional fields, a model with linear gradient is developed, which should be used if the gradient of the field, rather than the scalar field itself, is of interest. The numerical results, which were obtained using a digital computer, are shown for some two-dimensional problems. The results include the bounds on the Dirichlet integral. The virtual mass coefficients of an accelerating body in a bounded fluid were calculated using the two models for a circular cylinder and for a rectangular body. Dissert. Abstr.

N72-14616 California Univ., Los Angeles.
THE WIENER-HERMITE EXPANSION WITH A TIME DEPENDENT BASE AND THE PROBLEM OF TURBULENCE Ph.D. Thesis
Willard Cary Clever 1970 144 p
Avail: Univ. Microfilms Order No. 71-608

The Wiener-Hermite expansion of a random variable, applicable to problems of fluid turbulence, expands the variable in an infinite series, with a complete set of ideal random functions as its basis and in which the first term has exactly Gaussian statistics. The consequences were examined of using a time-dependent base to overcome certain problems. The idea of a moving base system was tested on homogeneous Burgers' turbulence for ease of computation and because of some similarities to real fluid turbulence. The requirements for constant statistics of the random base were derived, and it is shown that such a time-dependent base does not affect any of the moments of the system being considered. Improved results occur with the moving base due to a more rapid series convergence and choosing initial conditions closer to those which arise naturally. Using the same moving base system, a three-term expansion was attempted, using a simplified set of equations. Dissert. Abstr.

N72-14617 California Univ., Los Angeles.
QUASILINEARIZATION SOLUTIONS OF DIFFERENTIAL GAMES AND EVALUATION OF SUBOPTIMAL STRATEGIES Ph.D. Thesis
Rollyn Gene Graham 1970 284 p
Avail: Univ. Microfilms Order No. 71-624

The first-order necessary conditions for an optimal solution are derived for a very general problem in differential games. The problem statement includes terminal constraints, control and state variable inequality constraints, multiple arc solutions, and state variable discontinuities at specified and free corners. The problems of determining optimal solutions when the strategy of the opponent is known and when the strategy of the opponent is unknown and perhaps optimal are both treated. The comparison of the performances associated with these two cases provides a measure of the efficacy of a selected, suboptimal strategy. The first-order necessary conditions constitute a multipoint boundary value problem. The quasilinearization technique is extended to handle this problem, including the effects of control and state variable inequality constraints, multiple arc solutions, and discontinuities in the state and adjoint variables. Dissert. Abstr.

N72-14618# Sheffield Univ. (England). Dept. of Probability and Statistics.
ON THE CONCEPT OF ASYMPTOTIC RELATIVE DEFICIENCY
G. C. Arnold Jun. 1971 8 p ref
(RR-82/GCA-1) Avail: NTIS

The concept of asymptotic relative deficiency is discussed in detail. It is shown how this concept may be used as a means of improving the classical maximum likelihood estimates. Author

N72-14619*# Texas A&I Univ., Kingsville. Dept. of Mathematics.
THE GENERATION OF RANDOM NUMBERS ON THE IBM 360/44
F. M. Speed and L. C. Laurito Apr. 1971 68 p refs
(Grant NGR-44-073-003)
(NASA-CR-115308; TR-1) Avail: NTIS CSCL 12A

A summary is presented of the generation and testing of random numbers on the IBM 360/44 computer. Various generators and statistical tests are considered. Author

N72-14620*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON LASHINSKY S EQUATION y'' PLUS alpha y' MINUS ay PLUS by CUBED EQUALS O
Ferdinand F. Cap Dec. 1971 16 p refs
(NASA-TM-X-65781; X-641-71-481) Avail: NTIS CSCL 12A

A differential equation proposed by H. Lashinsky to describe the nonlinear solution of aperiodic instabilities is investigated. Oscillatory and nonoscillatory solutions are discussed and a numerical integration is presented. Author

N72-14621# Rice Univ., Houston, Tex.
NUMERICAL EXPERIMENTS ON HESTENES' METHOD OF MULTIPLIERS FOR MATHEMATICAL PROGRAMMING PROBLEMS
A. Miele, P. E. Moseley, and E. E. Cragg 1971 18 p refs
(Grant NSF GP-27271)
(AAR-85) Avail: NTIS

The problem of minimizing a function f(x) subject to a constraint phi(x) = 0, where f is a scalar, x an n-vector, and phi a q-vector, with q < n is considered. Hestenes' method of multipliers is employed in conjunction with the ordinary gradient algorithm and the conjugate gradient algorithm. In this method, the vector x is viewed as unconstrained, and the function f(x) is replaced by the augmented penalty function W(x,lambda,k) = f(x) + lambda sup T phi(x) + k phi sup T (x)phi(x). Here, the q-vector lambda is the Lagrange multiplier and the scalar k > 0 is the penalty constant. Hestenes' method of multipliers is tested and evaluated through three numerical examples dealing with nonquadratic functions and nonlinear constraints. From the examples, the following conclusions arise: (1) the method of multipliers is superior to the standard penalty function method; (2) the method exhibits poor convergence characteristics when employed in conjunction with the ordinary-gradient algorithm; (3) the method exhibits good convergence characteristics when employed in conjunction with the conjugate-gradient algorithm; and (4) with reference to (3), convergence does not occur for any value of the penalty constant, but only if k is in a proper range. Author

N72-14622# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering.
A MODIFICATION OF THE METHOD OF MULTIPLIERS FOR MATHEMATICAL PROGRAMMING PROBLEMS
A. Miele 1971 22 p refs
(Grant NSF GP-27271)
(AAR-86) Avail: NTIS

The problem of minimizing a function f(x) subject to a constraint phi(x) = 0, where f is a scalar, x an n-vector, and phi a q-vector, with Q < n is discussed. A modification of Hestenes' method of multipliers is presented, with one idea in mind: to accelerate convergence. The modification consists in imbedding Hestenes' updating rule into a one-parameter family of updating rules and determining the scalar parameter beta so that the total error in the system is minimized and increasing the updating frequency so that the number of iterations in a cycle is delta N = 1 for the ordinary-gradient algorithm and delta N = n for the conjugate-gradient algorithm. Three numerical examples are presented, and it is shown that the modified method of multipliers exhibits faster convergence than Hestenes' method of multipliers in connection with both the ordinary-gradient algorithm and the conjugate-gradient algorithm. Author

N72-14623# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering and Materials Science.
UNCONSTRAINED APPROACH TO THE EXTREMIZATION OF CONSTRAINED FUNCTIONS
H. Y. Huang and S. Naqvi 1970 29 p refs
(Grant NSF GP-27271)
(AAR-82) Avail: NTIS

The problem of extremizing a function f(x) subject to the constraint phi(x) = 0 is considered. This problem is transformed into that of minimizing the unconstrained function R(x,lambda), where x and lambda are regarded as independent variables. The q-vector lambda is the Lagrange multiplier associated with the constraint, and the function R(x,lambda) is the performance index measuring the cumulative error in the optimum condition and the constraint. The minimum R(x,lambda) = 0 of the performance index is sought by applying quadratically convergent algorithms for unconstrained function minimization: the (n+q)-vector y = (x,lambda) to the Tth power is the independent variable associated with the performance index R(y). A two-point quasilinearization search is developed with respect to the one-dimensional determination of the stepsize alpha. The method presented is a first-order method. For the ideal case of quadratic function subject to a linear constraint, it converges to the solution in n + q iterations, at most. Three numerical examples are given using both the exact search and the one-cycle search. The results are presented in terms of number of iterations and number of function evaluations for convergence. Author

N72-14624# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences Section.
TIME SERIES ANALYSIS AND NONLINEAR FILTERING
R. Gran Jan. 1972 28 p refs
(RM-530) Avail: NTIS

A promising approach to the identification of filtering parameters is presented. Two approximations to nonlinear filters were tried, one of which gives good estimates of the unknown parameters. Further, a third moment filter is described. Statistical tests are also described which show when the estimates have converged, and results of numerical experiments are presented. Author

N72-14625*# Scientific Translation Service, Santa Barbara, Calif.
CODING A SEQUENCE OF DISCRETE READINGS OF MONOTONIC FUNCTIONS
A. B. Kryukov Washington NASA Apr. 1971 10 p ref Transl. into ENGLISH from Chetverty Simpozium po Probl. Izbytochnosti v Inform. Systemakh (Leningrad), v. 2, 1970 p 388-395 Presented at the 4th Symp. on the Probl. of Redundancy in Inform. Systems, Leningrad, 1970
(Contract NASw-2035)
(NASA-TT-F-13865) Avail: NTIS CSCL 12A

Data compression of a sequence of monotonic functions by a binary number sequence is treated. The contraction of the code increases with the number of data points. Author

N72-14626# Aeronautical Research Labs., Melbourne (Australia).
THE METHOD OF THE FALSE TRANSIENT
G. D. Mallison and G. DeVahlDavis Jun. 1971 12 p refs
(ARL/SM-Note-367) Avail: NTIS

A method for the numerical solution of coupled nonlinear partial differential equations is described. The essence of the method is the replacement of elliptic equations by parabolic ones which were obtained by the introduction of false transient terms. The method is thus suitable only for determining steady state solutions. The method was extended to facilitate application to more complex systems. Tests were conducted by solving a problem of natural convection; a comparison with previously obtained experimental results indicate that the method of the false transient is at least an order of magnitude faster than the conventional inner and outer iteration scheme. Author

N72-14627*# Scripta Technica, Inc., Washington, D.C.
STABILIZATION OF OPTIMAL DIFFERENCE PROCEDURES FOR NUMERICAL INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS Ph.D. Thesis - Eidgenossische Technische Hochschule, 1969
H. Brunner NASA Jun. 1971 72 p refs Transl. into ENGLISH of "Stabilisierung Optimaler Differenzenverfahren zur Numerischen Integration Gewoehnlicher Differentialgleichungen" Rept. Diss-4182 Zurich, Juris Durck and Verlag, 1969 86 p
(Contract NASw-2036)
(NASA-TT-F-13856; Diss-4182) Avail: NTIS CSCL 12A

An exposition of procedures is presented for approximation of particular solutions to linear and nonlinear differential equations (or systems of equations) by means of difference equations. The results of the classical and modified procedures are compared for specific examples. Questions of convergence, stability (relative and absolute), consistency, and optimality are treated. Author

N72-14628# Kernforschungsanlage, Juelich (West Germany). Zentralinst. fuer Angewandte Mathematik.
INVESTIGATION OF THE PROBLEM OF CHARACTERISTIC

VALUE AND NONNEGATIVE SOLUTION OF A GENERAL STATIONARY TRANSPORT EQUATION
Franz Ebersoldt Nov. 1970 56 p refs In GERMAN
(JUL-711-MA) Avail: AEC Depository Libraries

The time-independent problem associated with the homogeneous stationary transport equation (A - B)phi = lambda C phi is considered. A convex body surrounded by a perfect absorber is considered as the reactor. The problem is reduced to the study of the eigenvalues and functions of the operator C/(A - B). It is shown that under a physically rational condition of this operator, defined on the complex L sug 2, a completely constant representation of the space in it is represented. On the basis of the Riesz-Schauder theory of compact operators it follows that only discrete characteristic values, which can not be accumulated in the finite, are given. The existence of a positive fundamental solution with a pertinent positive extreme characteristic value is proved. NSA

N72-14629# Army Foreign Science and Technology Center, Charlottesville, Va.
AN APPROXIMATE DETERMINATION OF SOME NON-LINEAR PROBLEMS OF THE THEORY OF HEAT TRANSFER
A. N. Lunnov and B. G. Ogloblin 26 Jun. 1971 9 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 17, no. 5, 1969 p 913-917
(AD-728706; FSTC-HT-23-1166-71; T702301-2301) Avail: NTIS CSCL 12/1

In this article approximate solutions of problems of unsteady heat flow for thermal radiation from a plate, solid and hollow cylinders, and from a sphere in the presence of internal sources of heat are obtained. The solutions are obtained on the basis of assuming a parabolic temperature profile. Author (GRA)

N72-14630# Control Data Corp., Washington, D.C. C-E-I-R Professional Services Div.
FURTHER RESULTS ON ESTIMATION OF THE PARAMETERS OF THE PEARSON TYPE 3 DISTRIBUTION Final Report
W. R. Blischke Wright-Patterson AFB, Ohio ARL Mar. 1971 61 p refs Prepared in cooperation with Synergetic Sci., Inc., Tarzana, Calif.
(Contract F33615-70-C-1136; AF Proj. 7071-00-11)
(AD-728677; ARL-71-0063; DoD-Element-61102F; DoD-Subelement-681304) Avail: NTIS CSCL 12/1

The report is devoted to a continuation of research on problems in nonregular estimation, with special emphasis on the Pearson Type 3 distribution. New regularity conditions are applied to the Type 3 distribution. It is shown that the regularity conditions are satisfied if the shape parameter, alpha, exceeds two and the location parameter is the only unknown parameter. It follows from LeCam's results that the maximum likelihood estimator is asymptotically optimal in the usual senses when alpha = 2. The problem of estimating the shape and scale parameters of the Type 3 distribution with known location parameter is also considered. Author (GRA)

N72-14631# Army Foreign Science and Technology Center, Charlottesville, Va.
A NEW PROCEDURE FOR THE NUMERICAL SOLUTION OF GENERAL NON-LINEAR BOUNDARY VALUE PROBLEMS
I. V. Byeiko 26 Aug. 1971 16 p refs Transl. into ENGLISH from Nekot. Vop. Frikl. Mat. Analogovoi Vychislitelnoi Tekhn. (Kiev), no. 3, 1967
(AD-729552; FSTC-HT-23-463-71; T702301-2301) Avail: NTIS CSCL 12/1

Starting with the assumption that the vector function in boundary value problems has a continuously differential argument, a method that involves the construction of a series of paths which converge is described for solving problems of optimal control. F.O.S.

N72-14632# California Univ., Los Angeles. Dept. of Mathematics.
AN ISOPERIMETRIC PROBLEM FOR ENTIRE FUNCTIONS Interim Report
Victor Barcilon 1971 6 p refs Submitted for publication
(Contract N00014-69-A-0200-4022; Grant NSF GA-19605; NR Proj. 044-144)
(AD-729234) Avail: NTIS CSCL 12/1

An isoperimetric problem arising in optimum antenna and circuit design is examined. It consists in maximizing a functional, subject to certain constraints, over the class of square integrable exponential functions of a given type. It is shown that the solutions of the corresponding Euler-Lagrange equation form a complete set of functions whose properties generalize those of the prolate a spheroidal wave functions. Author (GRA)

N72-14633# Minnesota Univ., Minneapolis. School of Mathematics.
QUASI-LINEAR ELLIPTIC AND PARABOLIC EQUATIONS Terminal Report, Sep. 1970 - Sep. 1971
L. A. Peletier Aug. 1971 8 p refs
(Contract N00014-67-A-0113-0022; NR Proj. 041-406)
(AD-729674) Avail: NTIS CSCL 12/1

In this report the authors give an outline of the work performed under the contract. For more detailed discussions the authors refer to the five technical reports which go with this terminal report. The titles of the technical reports are the following: Similarity profiles of flows through porous media; Asymptotic behaviour of solutions of the porous media equation; On the asymptotic behaviour of velocity profiles in laminar boundary layers; Limit conditions on the solutions of quasi-linear elliptic and parabolic equations; and on the stability of symmetric and asymmetric concentration profiles in catalyst particles. GRA

N72-14634# Stanford Univ., Calif.
TIME DEPENDENT MATHEMATICAL PROGRAMS Final Report, 20 Jan. 1967 - 31 May 1971
B. Curtis Eaves 1971 16 p refs
(Contract DAHC04-67-C-0028; DA Proj. 2O0-061102-B-14-C)
(AD-729397; AROD-6647-28-M) Avail: NTIS CSCL 12/2

The mathematical properties of time dependent systems such as those that arise in control problems and in problems of economic, industrial and military planning have been studied with the view to developing efficient algorithms for their practical solution on computers. The report presents a list of titles, authors, and summaries of reports generated by the study. Author (GRA)

N72-14635# California Univ., Los Angeles. Dept. of Mathematics.
OPTIMUM IMPULSE RESPONSE AND THE VAN DER MAAS FUNCTION
Victor Barcilon and Gabor C. Temes Aug. 1971 25 p refs
(Contract N00014-69-A-0200-4022; NR Proj. 044-144)
(AD-729412) Avail: NTIS CSCL 09/5

The optimum impulse response of a bandlimited system, viz., the van der Maas function, is derived from considerations based on the theory of entire functions. The L (sup 2)-version of the optimization problem is also discussed. In particular, it is shown that there is no square integrable impulse response which is optimum in Chebyshev's sense since the van der Maas function, which is not square integrable, can be regarded as the limit of a sequence of square integrable functions. Some modified L (sup 2)-version of the optimization problem, in which weighted square integral measures of the side-lobes are prescribed, are also described. Author (GRA)

N72-14636# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
CONTROL OF DYNAMIC SYSTEMS Final Report, 1 Apr. 1967 - 30 May 1971
J. P. LaSalle 25 Aug. 1971 20 p refs

(Grant AF-AFOSR-0693-67; AF Proj. 9749)
(AD-729932; AFOSR-71-2415TR) Avail: NTIS CSCL 12/1

The objective of the research is to develop theory and techniques for the analysis and design of large scale, multi-input, multi-output dynamical systems. Examples of such systems are aerospace and naval vehicles, chemical and industrial processes, air and ground traffic systems, economic systems, etc. The advance of technology and theory has made possible the analysis and control of such systems but yet there is a lack of effective means for modeling their behavior and for designing control strategies for improving performance. Author (GRA)

N72-14637# California Univ., Los Angeles. School of Engineering and Applied Science.
ON OUTPUT FEEDBACK STABILIZABILITY OF LINEAR SYSTEMS
M. T. Li Aug. 1971 11 p refs
(Grant AF-AFOSR-1328-67; AF Proj. 9749)
(AD-729462; AFOSR-71-2338TR) Avail: NTIS CSCL 12/1

A sufficient condition for a linear time-invariant system to be stabilizable by output feedback control is obtained by using a geometric approach. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-14638# National Weather Service, Fort Worth, Tex.
THE DECISION PROCESS IN HURRICANE FORECASTING
R. H. Simpson Jan. 1971 37 p refs
(NOAA-TM-NWS-SR-53) Avail: NTIS

The errors in numerical models for predicting the movement and development of hurricanes are discussed. An error in direction of movement as small as 8-10 degrees, nominally an acceptable one in a 24-hour forecast for extra tropical storm centers, can yield disastrous results in hurricane warnings if followed literally. The performance of most hurricane prediction models depends significantly upon the initial direction of movement of the center, which in turn depends upon an exact knowledge of the current center position and the position 6 and 12 hours earlier. The average positioning error is more than 20 nm, and often leads to initial direction errors of 15-20 degrees. The forecaster remains hard put to identify and diagnose the frailties of numerical prediction models for individual forecasts. All too often this has led to near abandonment of the guidance materials and the application of empirical and individual experience factors in decision making. Author

N72-14639# National Weather Service, Fort Worth, Tex.
STATISTICAL FORECASTS OF DEW POINTS IN NORTHEAST TEXAS WITH ONSET OF SOUTHERLY FLOW
Tommy W. Trimble Feb. 1971 16 p refs
(NOAA-TM-NWS-SR-54) Avail: NTIS

A study conducted in search of forecast procedures that would provide consistently good dew point forecasts for northeast Texas during periods favorable for the return of moisture from the Gulf of Mexico is reported. Specifically, reference is made to the increase in dew point temperatures in northeast Texas when the low level winds start blowing from the south following a period of north winds and low dew points. Regression equations for forecasting dew point increase were developed for four weather observation stations: Lufkin (LFK), Tyler (TYR), Shreveport (SHV), and Texarkana (TXK). Author

N72-14640# National Weather Service, Fort Worth, Tex.
MEMORABLE HURRICANES OF THE UNITED STATES SINCE 1873
Arnold L. Sugg Apr. 1971 54 p refs Revised
(NOAA-TM-NWS-SR-56) Avail: NTIS

Maps and descriptions of major hurricanes effecting the United States since 1873 are presented. Figures concerning property loss, loss of life, and variations in meteorological parameters are included. The classification system which is applied to the intensity of the hurricane is discussed. Author

N72-14641*# Georgia Univ., Athens. Dept. of Physics.
USE OF THE NEGATIVE BINOMIAL-TRUNCATED POISSON DISTRIBUTION IN THUNDERSTORM PREDICTION
A. C. Cohen Dec. 1971 18 p refs
(Contract NAS8-11175)
(NASA-CR-61370) Avail: NTIS CSCL 04B

A probability model is presented for the distribution of thunderstorms over a small area given that thunderstorm events (1 or more thunderstorms) are occurring over a larger area. The model incorporates the negative binomial and truncated Poisson distributions. Probability tables for Cape Kennedy for spring, summer, and fall months and seasons are presented. The computer program used to compute these probabilities is appended. Author

N72-14642*# Bellcomm, Inc., Washington, D.C.
PROBING ATMOSPHERIC WATER VAPOR PROFILES VIA MULTIPLE SCATTERING OF ELECTROMAGNETIC WAVES
C. C. H. Tang 26 Nov. 1971 50 p refs
(Contract NASw-417)
(NASA-CR-124757; TM-71-1011-7; Case-105-9) Avail: NTIS CSCL 04B

A theoretical analysis on the multiple scattering of electromagnetic waves propagating in a finite inhomogeneous medium is presented and applied to the study of wave propagation in a clear atmosphere (fine weather conditions). It is shown that the analysis offers a method of synthesizing the water vapor density profile in a clear atmosphere by measuring the resultant reflections from the density profile at several different frequencies. It is also shown that the resultant reflection emerges as the consequence of multiple scattering of partial reflections from various parts of the inhomogeneous medium. The solutions of the multiple scattering approach are shown to be more accurate than those of the WKB approach, which neglects the multiple scattering effects. Author

N72-14643# Finnish Meteorological Office, Helsinki.
THE SEA BREEZE IN SOUTH FINLAND ACCORDING TO A NUMERICAL MODEL
Gofran Nordlund 1971 28 p refs
(UDC-551.553.11:551.511.3; Contrib-77) Avail: NTIS

The sea breeze has been computed according to a numerical model, which is mainly based on the method developed by Estoque. However, in the present study the way of computing the advection terms and the vertical velocities differs from that used by Estoque. The computation results were in fairly good agreement with the observations made of the sea breeze in Finland but, among other things, the computed sea breeze attained its maximum later than the observed. Because the numerical stability of the model was not good enough for a prognosis of more than 12 hours, the change from sea breeze to land breeze could not be presented. Author

N72-14644# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
SOME METEOROLOGICAL ASPECTS OF THREE INTENSE FOREST FIRES
R. J. Taylor, D. G. Corke, N. K. King, D. A. MacArthur, D. R. Packham, and R. G. Vines 1971 20 p refs
(Tech-Paper-21) Avail: NTIS

A study is reported of three intense forest fires, all of area about 30 km2, in which convection extended to heights ranging from 2750 m to 4300 m. The observations taken comprise surface-level wind, temperature, and humidity; mean tempera-

ture, temperature fluctuations, and vertical acceleration as measured from an aircraft; the rate of change of height of the aircraft while it was held at constant attitude; and wind profiles from double-theodolite pilot-balloon flights. Strong inflow into the smoke columns from all directions was observed to heights of at least 300 m. The consequent strong updrafts were manifest in large and rapid changes of the aircraft's height while penetrating the smoke directly above the fire at heights up to about 1 km, where there was intense turbulent activity. At greater heights, and away from the central area of the fire, the turbulence characteristics of the heated air were little different from those of the ambient unheated air. From heat conservation principles, a mean entrainment rate of 1.037 (standard error 0.002) per 100 m is deduced. Using this entrainment rate a particularly simple method of predicting the height of convection is proposed for situations where the atmosphere is not conditionally unstable; condensation levels derived from simple surface measurements may be used in this calculation. Author

N72-14645# Istituto di Fisica Dell Atmosfera, Rome (Italy).
RECOVERY OF FOG MICROPHYSICAL PARAMETERS BY EXPERIMENTAL DATA ON LIGHT SCATTERING
G. Cappuccio, C. Corradini, B. Favale, G. Rocchetti, and G. Tonna
Nov. 1970 85 p refs
(IFA-SR-32) Avail: NTIS

Fog droplet size distribution was determined from light scattering data with the aid of a computer program. The experiment was carried out in an artificial fog chamber, in which different types of fog, and the complete evolution cycle of each, could be produced. Scattering experiments were carried out with light from a He-Ne laser and five photomultipliers attached to pulse counters. Computer programs used to process the data are described. The method permits a rapid determination of a fog size distribution at any time during fog evolution. ESRO

N72-14646# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
PANAMA CANAL ZONE. GUN HILL Meteorological Data Report
Jan. 1971 75 p
(AD-729321) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at Gun Hill, Panama Canal Zone during January 1971: atmospheric precipitation, atmospheric temperature, atmospheric pressure, humidity, and wind. GRA

N72-14647# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
PANAMA CANAL ZONE. FORT SHERMAN Meteorological Data Report
Dec. 1970 76 p refs
(AD-729320) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at Fort Sherman, Panama Canal Zone during December, 1970: Atmospheric precipitation; Atmospheric temperature; Atmospheric pressure; Humidity; Wind. GRA

N72-14648# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
PANAMA CANAL ZONE. CHIVA-CHIVA OPEN, CHIVA-CHIVA JUNGLE Meteorological Data Report
Dec. 1970 62 p refs
(AD-729318) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at sites within the Panama Canal Zone during December 1970: Atmospheric precipitation; Atmospheric temperature; Atmospheric pressure; Humidity; Wind. GRA

N72-14649# Weather Science, Inc., Norman, Okla.
THE ANALYSIS OF AIRBONE STEREOPHOTOGRAPHIC AND RAIN PARAMETER DATA OF PROJECT CLOUD PUFF 4
Joe L. Sutherland and Lynn W. Copper 25 May 1971 59 p refs
(Contract F19628-70-C-0228; AF Proj. 7605; Cloud Puff Proj. 4)
(AD-729505; WR102; AFRCL-71-0380; SR-1) Avail: NTIS CSCL 04/2

Aircraft-measured stereophotographic and rain parameter data collected during Project Cloud Puff IV have been analyzed. Results of the rain parameter analysis show that cumulus congestus clouds seeded with 40 to 60 grams of silver iodide are different than natural cumulus congestus in the following ways: (1) The seeded clouds produced 72% more rain, statistically significant at 15% (2) The heavier rain in the rainshafts of the seeded clouds was concentrated in smaller cores (3) The raindrop percentage distributions of the seeded rain showed higher percentage frequencies for 1 mm diameter drops at rainrates below 15 mm/hr, and an opposite effect at rainrates above 15 mm/hr. Subjecting the stereophotographic technique to an error analysis has shown that the height of cloud features 10 nm from the aircraft can be determined with an accuracy of 3 to 5%. Cloud features can be located within an error circle of 1.5 nm diameter when the aircraft is radar tracked and 5 nm diameter when the aircraft track is determined from radionavigational aids. These errors increase as distance of the cloud feature to the aircraft increases. Author (GRA)

N72-14650# Army Natick Labs., Mass. Earth Sciences Lab.
A COMPARISON OF ANNUAL RAINFALL PROBABILITIES IN THAILAND AND THE CANAL ZONE VICINITY
Ruth L. Wexler Mar. 1970 64 p refs
(DA Proj. 1T0-62112-A-129)
(AD-729349; ES-56; USA-NLABS-TR-70-39-ES) Avail: NTIS CSCL 04/2

Annual rainfall probabilities are compared among stations in the Canal Zone and Thailand. A variety of probability maps and charts are provided. Universal descriptors of annual rainfall regimes are sought in statistical parameters. Despite the total amount of rainfall at any one point, fairly extensive areas are often subject to approximately the same degree of relative variation of annual rainfall. Consequently, the set of the mean and the coefficient of variation is used to characterize annual rainfall. This set of statistics yields reasonably reliable predictions for design or long-range planning. On the whole, the rainfall of the Canal Zone is somewhat heavier and less variable than that of Thailand. Author (GRA)

N72-14651# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
PANAMA CANAL ZONE. TANK FARM, NRL 1, NRL 2, HAWK 1, HAWK 2 Meteorological Data Report, Jan. 1971
Jan. 1971 61 p
(AD-729825) Avail: NTIS CSCL 04/2

Meteorological data are given for sites within the Panama Canal Zone for the month of January, 1971. GRA

N72-14652# Atmospheric Sciences Office, White Sands Missile Range, N.Mex.
SPECTRAL ANALYSES OF HIGH-FREQUENCY ATMOSPHERIC TEMPERATURE FLUCTUATIONS
Thomas H. Price and Gaylon S. Campbell Ft. Monmouth, N. J. ECOM May 1971 39 p refs
(DA Proj. 1T0-61102-B-53-A)
(AD-729791; ECOM-5387) Avail: NTIS CSCL 04/2

Experiments were conducted by the Atmospheric Sciences Laboratory at White Sands Missile Range, New Mexico, to determine the shape and behavior of the temperature spectrum under different atmospheric conditions. Results of these experiments are presented in this report along with a description of equipment and techniques used. Deviations from the Obukhov-Kolmogorov hypothesis of -5/3 slope in the inertial subrange were found when strong buoyancy effects were present or at very low wind speeds. Author (GRA)

N72-14653# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

A STATISTICAL MODEL FOR ESTIMATION OF VARIABILITY VARIANCES FROM NOISY DATA

Louis D. Duncan Ft. Monmouth, N. J. ECOM May 1971 29 p refs

(DA Proj. 1T0-61102-B-53-A)

(AD-729790; ECOM-5385) Avail: NTIS CSCL 04/2

A statistical model is developed which yields estimates of space and time variability variances (atmospheric). Reasonable assumptions were made to extract the measurement error. A model of an experiment wherein measurements are taken simultaneously at two stations and at two fixed times is analyzed in detail. To obtain a solution for this case it was necessary to make assumptions of equality of certain covarinaces of space and time variability. The model was then extended to the case of N (2) temporal observations. In this case it was only necessary to assume a reasonable regularity among the random variables representing space variability. Methods for attacking the more general experiment are discussed briefly.

Author (GRA)

N72-14654# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

A LEAST-SQUARES WEIGHTED-LAYER TECHNIQUE FOR PREDICTION OF UPPER WIND EFFECTS ON UNGUIDED ROCKETS

W. B. Miller, Abel Blanco, and L. E. Traylor Jun. 1971 37 p refs

(DA Proj. 1T0-61102-B-53-A)

(AD-729792; ECOM-5382) Avail: NTIS CSCL 04/2

In the study, the weighted-layer technique for prediction of upper wind effects on unguided missiles is examined in detail, with attention being focused on rationale and difficulties in application. A technique is developed to determine weighting factors by use of a ballistic simulator, and a least-squares procedure which chooses those weights which minimize deflections from no wind impact. The bahavior of the weights so calculated is discussed, particularly with regard to possible ill conditioning of the linear system produced by the least-squares technique. Finally, actual data are examined, weights are calculated, and their behavior analyzed in terms of the previously developed theory. Author (GRA)

N72-14655# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A MANUALLY OPERATED DEW OR FROST POINT HYGROMETER SYSTEM USING CO2 COOLANT

James R. Patchell Jul. 1971 28 p refs

(RDT/E Proj. 1T0-61102-A-33-D)

(AD-729774; BRL-MR-2110) Avail: NTIS CSCL 04/2

A simple, inexpensive, manually operated dew- or frost-point hygrometer has been designed, fabricated and installed in a system that functions at atmospheric pressure and vacuum. It is intended primarily for the detection of water vapor pressure in a confined space at vacuum, as encountered in free-flight aerophysics ranges. Illustrations, with dimensions of the hygrometer's component parts, are presented. Calibration and operation procedures are described and the results of the test are reported. Author (GRA)

N72-14656# Naval Scientific and Technical Information Centre, Orpington (England).

THE ROLE OF ADVECTION IN THE THERMAL INTERACTION OF SEA AND ATMOSPHERE

E. F. Babenkov Jun. 1971 56 p refs Transl. into ENGLISH from Gos. Okeanogr. Inst. Tr. (USSR), no. 84, 1965 p 132-169

(AD-729751; NSTIC-Trans-2451; NSTIC-30610) Avail: NTIS CSCL 04/2

The basic laws and results of the inter-latitude heat transfer over the oceans and continents are established and analyzed. The significance of the general circulation of the atmosphere is that the coefficient of advection heat-transfer over the oceans is several times greater than the advection heat-transfer over the continents. Author (GRA)

N72-14657# Weather Wing (3rd), Offutt AFB, Nebr.

AN OBJECTIVE TECHNIQUE FOR FORECASTING WINTERTIME RADIATION FOG AT FAIRCHILD AFB, WASHINGTON

Dwayne N. Burgess (Fairchild AFB, Washington) and Darrell T. Holland Sep. 1971 13 p

(AD-729868; Rept-3WW-TN-71-2) Avail: NTIS CSCL 04/2

The paper presents an objective technique for forecasting wintertime radiation fog at Fairchild AFB, Washington. Using data available by 1500LST, a technique is presented to forecast the occurrence or non-occurrence of radiation fog restricting visibility to less than two miles between 0000LST and 0800LST for the months November through February. Eight predictors were examined: five combinations showed promise; three combinations were used in this study. Predictor combinations used in this study are: Surface wind speed versus temperature-dew point temperature; temperature versus temperature - dew point temperature; and surface wind speed versus dew point temperature. Period of record used: 1952-1962. Independent sample used: 1965-1966. Author (GRA)

N72-14658# Systems Science and Software, La Jolla, Calif.

THE EFFECTS OF MESO-SCALE AND SMALL-SCALE INTERACTIONS ON GLOBAL CLIMATE Semiannual Technical Report, 15 Feb. - 1 Sep. 1971

30 Sep. 1971 199 p refs

(Contract DAHC04-71-C-0018; ARPA Order 1752)

(AD-730748; Rept-3SR-795; Code-G1101D) Avail: NTIS CSCL 04/2

The present study was undertaken in an effort to improve numerical models for meso-scale and small-scale effects which influence global weather and its modification. Two major areas are being studied: the effects of mountain ranges on energy and momentum transfer, and the transient interactions of solar radiation with the earth's atmosphere. It is hoped that the results of these studies will lead to calculationally inexpensive prescriptions which can be incorporated into meso-scale and global-scale atmospheric circulation codes. Author (GRA)

N72-14659# Naval Weather Service Command, Washington, D.C.

SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 11: AREA 31, BONIN ISLANDS; AREA 32, VOLCANO ISLAND; AREA 33, MARCUS ISLAND

Sep. 1971 484 p refs

(AD-730958) Avail: NTIS HC $6.00/MF $0.95 CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 TDF-11, marine surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. This volume contains meteorological data for the Bonin Islands, Volcano Islands, and Marcus Island. GRA

N72-14660# Naval Weather Service Command, Washington, D.C.

SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 10: AREA 28, SOUTHERN YELLOW SEA; AREA 29, INCHON; AREA 30, KOREAN BAY

Sep. 1971 482 p refs

(AD-730957) Avail: NTIS HC $6.00/MF $0.95 CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asherville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas described in the

report include the Southern Yellow Sea, Inchon area, and Korea Bay. GRA

N72-14661# Weather Wing (5th), Langley AFB, Va.
MESO-SCALE ANALYSIS AND FORECASTING
Maurice E. Pautz 15 Sep. 1971 44 p refs
(AD-730327; Rept-5WWTN-71-5) Avail: NTIS CSCL 04/2

A collection of meso-scale analysis and forecasting techniques to aid the station forecaster in making improved short-range forecasts. These techniques include plotting and analysis of the pressure, temperature, streamline and upper air fields with methods to use these fields for forecasting. Even though these methods are not new this manuscript brings all the current techniques into one collection. Author (GRA)

N72-14662# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
YUMA PROVING GROUND, ARIZONA, CENTRAL METEOROLOGICAL OBSERVATORY Meteorological Data Report, Feb. 1971
Feb. 1971 69 p
(AD-730698) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at sites within Yuma Proving Ground, Arizona, during February 1971: Atmospheric precipitation; Atmospheric pressure; Atmospheric temperature; Humidity; Wind. GRA

N72-14663# Kaysam Corp. of America, Paterson, N.J.
DEVELOPMENT OF A 100,000 FOOT, MEDIUM FAST RISE BALLOON Final Report, 1 Jan. - 30 Jun. 1971
John Kantor 7 Sep. 1971 37 p
(Contract F19628-71-C-0096; AF Proj. 6670-03-01)
(AD-730334; AFCRL-71-0427; DoD-Element-62101F; DoD-Subelement-686670) Avail: NTIS CSCL 04/2

Research was conducted with an objective of developing a low cost sounding balloon capable in all zones, by day and during night flight, of attaining a minimum altitude of 100,000 feet at an approximate ascensional rate of 1,500 feet per minute. A study was made of high modulus balloon films. Also, three designs for spherical, lenticular and carrier balloons were developed. Preliminary balloon models of the three designs were fabricated and evaluated in flight at Hanscom Field, Bedford, Massachusetts. Evaluation of flight results showed that the carrier type balloon meets flight specifications. This design is easy to handle in the field, provides rapid ascent rate from the ground to the tropopause, and can be manufactured readily in production at low cost. Twenty final engineering models of this carrier type balloon were fabricated for evaluation.
Author (GRA)

N72-14664# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
MAYNARD, MASSACHUSETTS, CENTRAL METEOROLOGICAL OBSERVATORY
Jan. 1971 76 p
(AD-730694) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at Central Meteorological Observatory, Maynard, Massachusetts, during January 1971: Atmospheric precipitation; Atmospheric temperature, Atmospheric pressure; Humidity, Wind. GRA

N72-14665# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
STEADY STATE TWO DIMENSIONAL AIR FLOW IN FORESTS AND THE DISTURBANCE OF SURFACE LAYER FLOW BY A FOREST WALL
Joseph H. Shinn Fort Monmouth, N. J. ECOM May 1971 113 p refs
(DA Proj. 1T0-61102-B-53-A)
(AD-730681; ECOM-5383; Task-1-T-061102-B-53-A-17; OSD-1366) Avail: NTIS CSCL 04/2

New semi-empirical models are obtained of the mean momentum transport processes in and above forests for two contrasting micrometeorological problems: (1) the equilibrium air flow in forests far upwind of any inhomogeneity in the fetch, and (2) the nonequilibrium air flow in the transition region of the surface layer flow disturbed by the entrance into a forest. The study is confined to neutral stability conditions. Experimental data are from studies in eight forests and a wind tunnel simulation. The equilibrium mean velocity profiles in forest canopies are shown to be two-dimensional. A lateral component of flow increases downward from the top of the canopy. A semi-empirical model of mean velocity components is derived and verified for the upper 90% of the forest canopy depth. In the nonequilibrium flow in the transition region downwind of a forest wall: (a) The logarithmic velocity profile is found to be an empirical approximation for the lower part of the boundary layer, assuming that only the friction velocity varies with downstream distance. An empirical relation for the horizontal variation of the friction velocity is obtained. (b) The mean velocity profiles in a mixing zone located at midcanopy level are shown to have a low-level velocity maximum and horizontal similarity.
Author (GRA)

N72-14666# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab.
WIND PREDICTABILITY AND REMOTE SENSING TECHNIQUES
John G. Gilley and David Hoffman Sep. 1971 75 p refs
(AD-730712; QEEL-TR-12; Job-1-1304-1) Avail: NTIS CSCL 04/2

The report presents the unclassified findings from the Investigation of Airborne Wind Sensing Systems conducted under AIRTASK A30303/323/70F17311002. Included is a summary of the current accuracy of wind speed and direction forecasts, a list of possible methods for remote sensing meteorological data, a list of areas of application of the given methods and a list of contacts made for information relevant to this evaluation. Author (GRA)

N72-14360# Joint Publications Research Service, Washington, D.C.
WIND REGIME IN LOWER THERMOSPHERE DURING CONDUCT OF SUN-ATMOSPHERE EXPERIMENT
I. A. Lysenko and A. D. Orlyanskiy *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 149-156 refs (See N72-14344 05-13)
(UDC-551.510.53) Avail: NTIS

N72-14361# Joint Publications Research Service, Washington, D.C.
FEATURES IN CIRCULATION OF ATMOSPHERE DURING SUN-ATMOSPHERE EXPERIMENT
R. F. Usmanov *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 157-171 refs (See N72-14344 05-13)
(UDC-551.510+523.745) Avail: NTIS

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-14667*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A METHOD FOR LUNAR ROVING VEHICLE POSITION DETERMINATION FROM THREE LANDMARK OBSERVA-

TIONS WITH A SUN COMPASS
T. J. Blucker and G. L. Stimmel (TRW Systems Group) 25 Jun. 1971 6 p
(NASA-TM-X-67447; MSC-04440; MSC-IN-71-FM-238) Avail: NTIS CSCL 17G

A simplified method is described for determining the position of the lunar roving vehicle on the lunar surface during Apollo 15. The method is based upon sun compass azimuth measurements of three lunar landmarks. The difference between the landmark azimuth and the sun azimuth is measured and the resulting data are voice relayed to the Mission Control Center for processing. Author

N72-14668*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SUN COMPASS ERROR MODEL
T. J. Blucker and W. W. Ferry (TRW Systems Group) 30 Jun. 1971 19 p
(Proj. Apollo)
(NASA-TM-X-67446; MSC-04445; MSC-IN-71-FM-241) Avail: NTIS CSCL 17G

An error model is described for the Apollo 15 sun compass, a contingency navigational device. Field test data are presented along with significant results of the test. The errors reported include a random error resulting from tilt in leveling the sun compass, a random error because of observer sighting inaccuracies, a bias error because of mean tilt in compass leveling, a bias error in the sun compass itself, and a bias error because the device is leveled to the local terrain slope. Author

N72-14669*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
GUIDANCE AND NAVIGATION REQUIREMENTS FOR UNMANNED FLYBY AND SWINGBY MISSIONS TO THE OUTER PLANETS. VOLUME 1: SUMMARY REPORT
Oct. 1971 43 p ref 4 Vol.
(Contract NAS2-5043)
(NASA-CR-114395; R-678-Vol-1) Avail: NTIS CSCL 17G

Unmanned spacecraft missions to the outer planets are of current interest to planetary scientists, and are being studied for the post 1970 time period. Flyby, entry and orbiter missions are all being considered using both direct and planetary swingby trajectory modes. The navigation and guidance requirements for a variety of missions to the outer planets and comets including both the three and four planet Grand Tours, are summarized. Author

N72-14670*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
GUIDANCE AND NAVIGATION REQUIREMENTS FOR UNMANNED FLYBY AND SWINGBY MISSIONS TO THE OUTER PLANETS. VOLUME 2: IMPULSIVE HIGH THRUST MISSIONS, PHASE A Final Technical Report
May 1969 444 p refs 4 Vol.
(Contract NAS2-5043)
(NASA-CR-114396; R-678-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 17G

The impulsive, high thrust missions portion of a study on guidance and navigation requirements for unmanned flyby and swingby missions to the outer planet is presented. The proper balance between groundbased navigational capability, using the deep space network (DSN) alone, and an onboard navigational capability with and without supplemental use of DSN tracking, for unmanned missions to the outer planets of the solar system is defined. A general guidance and navigation requirements program is used to survey parametrically the characteristics associated with three types of navigation systems: (1) totally onboard, (2) totally Earth-based, and (3) a combination of these two. Author

N72-14671*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
GUIDANCE AND NAVIGATION REQUIREMENTS FOR UNMANNED FLYBY AND SWINGBY MISSIONS TO THE OUTER PLANETS. VOLUME 3: LOW THRUST MISSIONS, PHASE B Final Technical Report
May 1970 209 p refs 4 Vol.
(Contract NAS2-5043)
(NASA-CR-114397; R-678-Vol-3) Avail: NTIS CSCL 17G

The guidance and navigation requirements for unmanned missions to the outer planets, assuming constant, low thrust, ion propulsion are discussed. The navigational capability of the ground based Deep Space Network is compared to the improvements in navigational capability brought about by the addition of guidance and navigation related onboard sensors. Relevant onboard sensors include: (1) the optical onboard navigation sensor, (2) the attitude reference sensors, and (3) highly sensitive accelerometers. The totally ground based, and the combination ground based and onboard sensor systems are compared by means of the estimated errors in target planet ephemeris, and the spacecraft position with respect to the planet. Author

N72-14672*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
GUIDANCE AND NAVIGATION REQUIREMENTS FOR UNMANNED FLYBY AND SWINGBY MISSIONS TO THE OUTER PLANETS. VOLUME 4: HIGH THRUST MISSION, PART 2, PHASE C Final Technical Report
Oct. 1971 261 p refs 4 Vol.
(Contract NAS2-5043)
(NASA-CR-114398; R-678-Vol-4-Pt-2) Avail: NTIS CSCL 17G

The guidance and navigation requirements for a set of impulsive thrust missions involving one or more outer planets or comets. Specific missions considered include two Jupiter entry missions of 800 and 1200 day duration, two multiple swingby missions with the sequences Jupiter-Uranus-Neptune and Jupiter-Saturn-Pluto, and two comets rendezvous missions involving the short period comets P/Tempel 2 and P/Tuttle-Giacobini-Kresak. Results show the relative utility of onboard and Earth-based DSN navigation. The effects of parametric variations in navigation accuracy, measurement rate, and miscellaneous constraints are determined. The utility of a TV type onboard navigation sensor - sighting on planetary satellites and comets - is examined. Velocity corrections required for the nominal and parametrically varied cases are tabulated. Author

N72-14673*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATION OF TECHNIQUES FOR IMPROVING SATURN 5 RF TRACKING AND RANGING SYSTEMS Final Summary Report
J. R. Walsh, Jr. and R. D. Wetherington 19 Nov. 1971 111 p refs
(Contract NAS8-20054; Proj. A-852)
(NASA-CR-121074) Avail: NTIS CSCL 17G

Results of theoretical analyses of 12 problems are presented and comparisons of theoretical and experimental results are given. The investigations covered were: (1) techniques for improving the Saturn radar altimeter, (2) performance of the phase lock loop of the offset Doppler transponder, (3) signal processing equipment design for an orbital altitude radar return experiment, (4) spectral studies of signals present in the command and communication system (CCS) up-link transmitter, (5) intermodulation in the CCS down-link data demodulators, (6) error rate performance of the CCS transponder command demodulator, (7) flame attenuation effects on telemetry transmissions during Saturn launches, (8) design of a digital television system which converts a standard monochrome picture to a slow-scan picture, (9) methods of obtaining an additional CCS 72-kilobit/sec telemetry channel, (10) computation of the CCS S-band down-link spectra, (11) modeling of portions of the communications systems, and (12) modeling of a telemetry transmitter. Author

N72-14674# Ohio Univ., Athens. Dept. of Electrical Engineering.
ALL-WEATHER, LOW-LEVEL NAVIGATION Semiannual Report, Oct. 1970 - Apr. 1971
Aug. 1971 57 p refs
(Contract DAAB07-68-C-0084; Proj. Themis)
(AD-729358; ECOM-0084-3; SAR-3) Avail: NTIS CSCL 17/7

During this reporting period a second Rubidium clock stabilized low-frequency transmitting station was mechanized with a phase-locked loop synthesizer to permit a flyable demonstration of a precision all-weather, low-level navigation system using passive, direct-ranging techniques. Phase measurements of the respective transmitter carriers are optimally obtained by means of two maximum likelihood receivers with an onboard clock. A General Automation SPC-12 digital computer provides coordinate conversion to an x-y position format, a route storage capability, and execution of a flight director algorithm. Extension and additions to the theoretical maximum likelihood receiver work provides a comprehensive comparison of this technique with the conversational phase-locked loop for phase estimation purposes. A special display-conventional terminal was designed and fabricated to provide a flexible and useful means of communicating with the SPC-12 computer both in the laboratory and during airborne exercises. Novel time and memory conserving computer software is also discussed.
Author (GRA)

N72-14675# Engins Matra, Velizy (France).
STAR MAPPER
J. V. Vaugien, J. Brillaud, and M. Germain Paris ESRO Jul. 1971 316 p In FRENCH
(Contract ESTEC-1107/70)
(ESRO-CR-43) Avail: NTIS HC $6.00/MF $0.95

The various problems experienced in devising a star mapper as well as the various possible solutions to them, are studied. The sort of signals that various kinds of detectors would receive from the stars is dealt with. A relationship is defined between the dimensions of the field of view and the number of stars that needs to be considered in order to acquire two or three stars with a certain probability. This study was performed with the aid of a computer, the actual position of the stars on the celestial sphere being used as input. Attention is then turned to electronic problems. Various detectors are evaluated and their ability to detect stars as a function of certain characteristics is discussed. This is followed by an examination of the various ways in which the data could be handled electronically onboard a spacecraft. Finally, a brief study is made of the hardware associated with the various solutions proposed. Mention is also made of a number of methods by which the pattern of stars seen by a detector could be recognized. Author (ESRO)

N72-14676# Aerospace Corp., El Segundo, Calif. Electronics Div.
DIGITAL ATTITUDE REFERENCE SYSTEM (DARS)
B. H. Campbell and T. C. Coffey 21 Dec. 1970 29 p refs
(Contract F04701-70-C-0059)
(AD-729430; TR-0059(6472)-7; SAMSO-TR-71-126) Avail: NTIS CSCL 22/3

A family of digital attitude reference systems (DARS) is developed for three-axis-stabilized, earth-oriented satellites. It includes the complete DARS configuration, which utilizes measurements from a sun sensor in addition to the horizon sensors and gyros in use on conventional analog gyrocompassing-type reference systems (CARS). The complete configuration also utilizes statistically optimal (Kalman) filtering to process these measurements to estimate and compensate for important measurement errors as well as to estimate the spacecraft attitude. Various suboptimal configurations of DARS are also studied. Based on simulation results, the attitude accuracies of the two most promising DARS configurations are approximately 0.03 and 0.04 deg, respectively, and the convergence time of both systems is less than 20 sec. Thus, DARS is shown to fill the important gap between low-accuracy gyrocompassing systems (using horizon sensors and gyros) and high-accuracy systems (requiring star sensors or trackers) by achieving intermediate attitude accuracy at the expense of low-to-medium complexity.
Author (GRA)

N72-14677# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRBORNE STATION KEEPING DEVICES Final Report
1 Aug. 1971 19 p refs
(AMER Proj. 310-6)
(AD-729532; MTP-6-3-208) Avail: NTIS CSCL 01/4

Procedures are defined for evaluating the ability of airborne station keeping devices to meet Army requirements.
Author (GRA)

N72-14678# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
RADIO NAVIGATIONAL EQUIPMENT, AM/FM Final Report
1 Aug. 1971 21 p refs
(AMCR Proj. 310-6)
(AD-729533; MTP-6-3-209) Avail: NTIS CSCL 17/7

Procedures are given for service testing radio navigational equipment, AM/FM. Author (GRA)

N72-14679# National Bureau of Standards, Washington, D.C.
APPROACHES TO EVALUATING THE EFFECTS OF VFR TOWERS ON FLOW AND SAFETY AT AIRPORTS
L. S. Joel, W. A. Steele, J. J. Filliben, and G. B. Hare Apr. 1971 185 p refs
(Contract DOT-FA70WAI-188; NBS Proj. 4314427)
(AD-729443; NBS-10562) Avail: NTIS CSCL 01/2

The Federal Aviation Administration is reviewing its criteria (now based on annual traffic levels) for airports to be eligible for the installation of VFR towers. In support of that review, a study was commissioned to seek mathematical methods and models for measuring the effects of a VFR tower on flow and safety at airports with different traffic volumes. The report discusses a variety of methodologies, viewpoints, and concepts. The first version of a mathematical model, intended to portray a tower's ability to expedite flow by abridging the full operation sequence, was formulated and exercised in illustrative calculations. Available aggregated data are not adequate for identifying functional relations between collision rates and activity levels at tower and non-tower airports; however a novel statistical approach has established the association between tower-presence and lower collision rates on a firmer basis than before. More knowledge is needed concerning pilots' information needs, relative to potential hazards, which go unmet in the absence of a VFR tower; as an initial contribution along this line, a computerized model was developed to air in studying the pilot's time-varying field of vision as limited by cockpit geometry and other structural obstructions. Author (GRA)

N72-14680# Florida Univ., Gainesville. Coll. of Engineering.
DIGITAL MISSILE CONTROLLER DESIGN AND ANALYSIS INFORMATION Final Technical Report
W. H. Boykin, Jr., T. E. Bullock, Jr., J. M. Elder, and B. D. Frazier May 1971 302 p refs
(Contract DAAH01-70-C-0639)
(AD-729854) Avail: NTIS HC $6.00/MF $0.95 CSCL 17/7

The report documents design and analysis information developed for the practical design and analysis of digital controllers of U.S. Army servo-actuator-vane controlled missiles. This information is in the form of a development of the design and analysis methods for high-order, multi-loop, multi-rate digitally controlled system, and computer programs for the practical analysis and design of such systems. The methods developed herein are: multi-loop, multi-rate simulation for time, and frequency responses of the digital guidance and control system with computing delays; classical frequency domain design and analysis of the multi-loop, multi-rate, open and closed-loop systems via the modified z-transform; emulation of the flight control computer on an IBM computer for memory, computing time and error analysis; automated modern design of the digital

compensators by solution of the 'linear-quadratic-loss' optimization problem and the Kalman filter; and, the determination of the optimization problem from the solution of the 'inverse problem' which transforms classical specifications into modern specifications. Author (GRA)

N72-14681# Illinois Univ., Urbana. Ionosphere Radio Lab.
FEASIBILITY STUDY OF CORRECTING FOR THE EXCESS TIME DELAY OF TRANSIONOSPHERIC NAVIGATIONAL RANGING SIGNALS Final Report, 15 Jun. 1970 - 15 Aug. 1971
N. Narayana Rao, Maurice Youakim, and Kung C. Yeh Jul. 1971 219 p refs
(Contract F04701-70-C-0234)
(AD-729797; TR-43; SAMSO-TR-71-163) Avail: NTIS CSCL 17/7

Navigational ranging satellite signals transversing the ionosphere experience a time-delay in excess of that in free space due to the presence of free electrons. This excess time-delay is proportional to the integrated electron density or electron content of the ionosphere along the path of the signal. Methods for correcting for the excess time-delay corresponding to the location of a user of the navigational ranging system are discussed. These methods are based on the use of the excess time-delay information gathered at a set of ground stations as input data. The degree of sophistication of the methods ranges from simple models in which no additional information based on past ionospheric data is required to models in which such additional information is necessary. Results obtained by subjecting the methods to a set of evaluation conditions demonstrate the capability to correct for the navigational ranging errors caused by the excess time-delay. These results also indicate the reduction in errors to be expected when additional information based on past ionospheric data is used. Further investigations are necessary to determine this information. Author (GRA)

N72-14682# Army Foreign Science and Technology Center, Charlottesville, Va.
DIRECTIONAL GYRO ATTACHMENT
K. Zimin and L. Shabarov 9 Jul. 1971 10 p Transl. into ENGLISH from Starshina-Serzhant (USSR), no. 2, 1971 p 20-22
(AD-729486; FSTC-HT-23-1264-71; T702301-2301) Avail: NTIS CSCL 05/9

An attachment to tank or tank trainer directional gyros for training use is described. GRA

N72-14683# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF GUIDANCE SCHEMES FOR AIR-TO-AIR MISSILES M.S. Thesis
John R. Stewart Jul. 1971 83 p refs
(AD-730161; GGC/EE/71-21) Avail: NTIS CSCL 17/7

A number of guidance laws which may be used in an air-to-air homing missile are presented. Primary emphasis is given to forms which use proportional navigation augmented by line of sight acceleration. It is concluded that the addition of the line of sight acceleration to proportional navigation does not significantly improve the terminal accuracy of homing missiles. Author (GRA)

N72-14684# California Univ., Los Angeles. School of Engineering and Applied Science
PASSIVE EDDY CURRENT NUTATION DAMPERS FOR DUAL SPIN SATELLITES
Gordon A. Haines Jun. 1971 80 p refs
(Grant AF-AFOSR-0699-67; AF Proj. 9749)
(AD-730385; UCLA-ENG-7133; AFOSR-71-2417TR; Task-61102F; Task-681304) Avail: NTIS CSCL 22/3

Nutational stability of dual-spin satellite systems is intimately related to the inertia properties of the vehicle and to the relative energy dissipation rates on the platform and spinner. Energy dissipation on the platform which may be required for stability can be efficiently achieved by passive eddy current nutation damping in which the nutational forcing function acts to impart relative motion between a permanent magnet and a conducting plate. The drag force on the magnet and resulting energy dissipation through eddy current generation in the conductor yield a dissipation rate per unit damper weight substantially greater than that obtainable by more conventional fluid dampers. In addition, an eddy current damper offers the following distinct advantages: it is durable, it does not require a fluid container, it is able to operate over extreme temperature ranges, it will withstand large nutation angles, it is able to damp small nutation since it is essentially free from stiction, and it may be conveniently tested in a 1-g environment. In this work the classical energy sink stability criterion for dual-spin systems is reviewed, the equations of motion of the damper are determined, and from these, the nutation damping time constant is derived. Optimization and trade-offs involved in the damper design to meet performance requirements over mission-required operation ranges of temperature, rotor spin speed, inertia properties, etc. are discussed with reference to a specific example. Author (GRA)

N72-14685# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ELECTRICAL DESIGN DATA FOR NAVIGATION ON BUOYS
Gene K. Huddleston and Wayne Rivers 15 Jun. 1971 97 p refs
(Contract DOT-CG-10657)
(AD-730971; GIT-A-1277-TR-2) Avail: NTIS CSCL 17/7

The electrical design of plastic buoys containing passive radar reflectors for use in radar navigation is discussed. The specific buoy configuration considered consists of a cylindrical homogeneous wall of uniform thickness (Radome) enclosing an octahedral radar reflector with the internal space filled with a low-density dielectric foam. Design data are presented to aid in the determination of optimum wall thicknesses and thickness tolerance for a number of candidate buoy wall materials. Computed performance data showing the reduction in radar cross section of the enclosed reflector due to the radome and filling for three orientations of the buoy are presented. A simplified flat-panel model of the radome/reflector system is developed which predicts with acceptable accuracy the wall transmission loss as a function of thickness and dielectric properties of the materials. Author (GRA)

N72-14686# Stanford Univ., Calif. Guidance and Control Lab.
PRECISION ATTITUDE CONTROL OF SYMMETRIC SPINNING BODIES
Kenneth R. Lorell and Benjamin Lange Apr. 1971 148 p refs
(Contracts F33615-67-C-1245; F33615-70-C-1637; AF Proj. 5102)
(AD-730854; SUDAAR-422; AFAL-TR-71-224; Task-510215) Avail: NTIS CSCL 22/2

Motivated by the arc-second pointing requirement of the Unsupported Gyroscope experiment and other satellite applications, this research investigates the problems associated with the precision attitude control of symmetric spinning bodies. An attitude control system is synthesized and then is studied by analog simulation. Controller performance and limitations are evaluated, using a laboratory model called the Spinning Vehicle Simulator (SVS). A technique devised at Stanford University in 1966 that simplifies the design of spinning-vehicle attitude controllers is used to select controller gains. The resulting system, simulated on an analog computer, produces excellent response characteristics and is insensitive to vehicle parameter or gain changes. The magnitude of the attitude error is shown to have zero-frequency and spin-frequency components proportional to the magnitude of body-fixed and inertially fixed moments, respectively. Author (GRA)

N72-14687# Analytic Sciences Corp., Reading, Mass.
OMEGA UTILIZATION FOR NON-MILITARY SUBSCRIBERS, VOLUME 1

Joseph F. Kasper, Jr. 27 Jul. 1971 47 p refs 2 Vol.
(Contract DOT-CG-94331-A)
(AD-730934; TASC-TR-192-2-vol-1) Avail: NTIS CSCL 17/7

A study addressed to the problem of making the OMEGA navigation system compatible with the needs of a wide spectrum of non-military users is summarized. The OMEGA system is briefly described along with the role of the Coast Guard in its future development; the goals of the study are outlined within this context. A survey of OMEGA configuration with emphasis on their applicability to non-military user needs is reviewed. Results of analyses of various aspects of OMEGA navigation based on quantities of actual phase data are discussed. Recommendations for future efforts toward the civilianization of OMEGA are included. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-14688 National Lending Library for Science and Technology, Boston Spa (England).
GAS COOLING IN NUCLEAR REACTORS
K. Ehlers, E. Schroeder, and U. Weicht 28 Jul. 1971 14 p Transl. into ENGLISH from Atomwirtschaft (Dusseldorf), no. 9, 10 Sep. 1970 p 76-80
(NLL-RISLEY-Tr-2038-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A reactor with development potential is the high temperature reactor in which helium is employed as the cooling gas. With the possibility of adopting higher gas and fuel temperatures, the utilization of gas turbines in a direct cycle and the generation of valuable process heat can be taken as objectives. The technical and economic possibilities, associated problems, and differences between the various gas-cooled types of reactors are discussed. Author

N72-14689*# Scientific Translation Service, Santa Barbara, Calif.
POSSIBLE SPACE APPLICATIONS OF NUCLEAR POWER SUPPLY, PARTICULARLY FOR DIRECT TELEVISION BROADCASTING
W. Rasch, W. Kleinkauf, U. Krupstedt, A. Quast, and W. Scharf Washington NASA Dec. 1971 370 p refs Transl. into ENGLISH from Einsatzmoeglichkeiten einer Nuklearen Energieversorgungsanlage in der Raumfahrt, Insbesondere fuer die Fernsehdirektubertragung, Inst. fuer Elektrische Antriebe und Energieversorgung, Bundesministerium fuer Bildung und Wissenschaft, Brunswick, rept. BMBW-FB-W-70-16, Apr. 1971 391 p
(Contract NASw-2035)
(NASA-TT-F-13980; BMBW-FB-W-70-16) Avail: NTIS HC $6.00/MF $0.95 CSCL 18E

Space applications of an incore-thermionic-reactor (ITR) are demonstrated by a direct broadcasting satellite. The electric power of the reactor is applied to the transmission of two television programs in the 800 Mhz range using vestigial sideband modulation. In addition, the 12 Ghz range is discussed. During the orbit transfer the reactor supplies four Kaufman ion thrustors transporting a satellite weighing about two tons from a 500 km parking orbit into a 24-hour orbit in 90 days. The main components of the satellite, power supply with an advanced cooling system and low voltage converter, electric propulsion system and television payload are described and discussed. Author

N72-14690# California Univ., Livermore. Lawrence Radiation Lab.
MIRROR REACTORS AND THE DIRECT CONVERSION OF PLASMA ENERGY TO ELECTRICAL FORM
R. W. Werner and J. D. Lee 14 May 1971 37 p refs Presented at the Intersociety Energy Conversion Eng. Conf., Boston, 3-6 Aug. 1971 Submitted for publication Sponsored by AEC
(UCRL-72877; Conf-710803-2) Avail: NTIS

Several different models of thermonuclear reactors are actively under study. Most of these models convert plasma energy to useful energy by thermal means and they are therefore Carnot-limited in efficiency. One exception to this is the mirror reactor with direct conversion. Direct conversion of plasma energy to electrical energy operates on the particle flux escaping through the ends of the mirror reactor. The charged particles with their high kinetic energy are caused to yield this energy to a series of electrostatic collectors in a process similar to an accelerator being run in reverse. A virtue of this system is that it can utilize cycles where neutron production is low and substantially all of the energy is in the form of charged particles. The reactor is therefore not a heat engine and not Carnot-limited. Efficiencies substantially higher than those of current systems are realizable with consequent reduction in waste heat compared to conventional conversion. The general process of direct conversion is discussed from an engineering viewpoint and the elements of a conceptual reactor are reviewed. Author (NSA)

N72-14691# Oak Ridge National Lab., Tenn.
RECENT DEVELOPMENTS IN THE SHIELDING OF NEUTRON SOURCES
H. Clyde Claiborne Jun. 1971 55 p refs
(Contract W-7405-eng-26)
(ORNL-RSIC-32) Avail: NTIS

The impact of CF-252 on shielding of neutron sources is discussed, the newer methods used for coupled neutron-gamma ray shielding calculations and shield weight optimization are reviewed, and some shipping cask designs for CF-252 and other transplutonium elements are discussed. The six papers on neutron source shielding that were contributed to the American Nuclear Society Topical Meeting on Neutron Sources and Applications at Augusta, Ga., 1971, are summarized and discussed. Two papers are about the attenuation properties of various materials for the neutrons from CF-252 and other neutron sources; one compares measurements and calculations for ten different shielded containers for CF-252; two involve the design of portable neutron source facilities; and one the use of tissue equivalent proportional counters for thin shield studies. Author (NSA)

N72-14692# Battelle-Northwest, Richland, Wash.
FUEL ROD ENRICHMENT DETERMINATION BY GAMMA-RAY SPECTROMETRY
A. D. Vaughn and R. L. Smith 1971 22 p refs Presented at 12th Ann. Meeting of the Nucl. Materials Management, West Palm Beach, Fla., 29 Jun. 1971
(Contract AT(45-1)-1830)
(BNWL-SA-3827; Conf-710617-32) Avail: NTIS

The plutonium concentrations in mixed oxide fuel rods containing distinct sizes of particulate plutonium oxide were determined using high resolution gamma-ray spectrometry. The fuel rod enrichments were in the range 2 to 2.5 wt. % PuO_2 in natural UO_2. Individual rod enrichments were determined to within + or - 5% by comparison with a known standard. Differences in plutonium isotopic composition were discernible also, in addition to differences in plutonium enrichment. The technique provides an inexpensive, non-destructive method of determining in-situ plutonium composition and content of assembled fuel rods, for purposes of quality assurance and accountability control. Author (NSA)

N72-14693# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
INVESTIGATION OF BEAM GUIDES AND STABILITY OF

PARTICLE MOVEMENT IN ACCELERATORS AND STORAGE RINGS WITH RIGOROUS CONSIDERATION OF A COUPLING OF THE BETATRON OSCILLATION
Gerhard Ripken Jun. 1970 67 p refs In GERMAN; ENGLISH summary
(DESY-R-1-70/4) Avail: AEC Depository Libraries

The theory of AG synchrotrons is extended to optical systems with x-z coupling. The beam and angular envelopes of linear and circular accelerators are determined by considering a four-dimensional ellipsoid in the x-x prime-z-z prime space. This ellipsoid is generated by four linearly independent trajectory vectors. In order to obtain the envelopes, the projections of the ellipsoid onto the x-x prime, z-z prime, and x-z planes are considered. The eigenvectors and eigenvalues of the transformation matrix which are necessary for the determination of the periodic envelopes are calculated rigidly. Instabilities due to distortions in the bending field and errors of the focusing fields are investigated. The four-dimensional envelope formalism is extended to a five-dimensional ellipsoid in the x-x prime-z-z prime-(delta p/p) space for studying the effects of a relative particle momentum deviation (delta p/p). Author (NSA)

N72-14694# Gulf Radiation Technology, San Diego, Calif.
DEVELOPMENT AND VERIFICATION OF DESIGN METHODS FOR DUCTS IN A SPACE NUCLEAR SHIELD, PHASES 1, 2, AND 3 Final Report
R. J. Cerbone, W. E. Selph, and P. A. Read 2 Nov. 1970 155 p refs
(Contract AT(04-3)-167)
(GULF-Rt-10394) Avail: NTIS

The development of a practical method for calculating the effects of ducts and cavities in a space nuclear shield is described. The verification of the accuracy of the method by analytical and experimental means is discussed. The DUCT code, analytical tests, and comparison with experiments designed to simulate a SNAP lithium hydride shield with Na coolant holes are presented. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-14695 Oregon State Univ., Corvallis.
ERROR ANALYSIS IN SCANNED HOLOGRAPHY Ph.D. Thesis
H. Dale Collins 1970 107 p
Avail: Univ. Microfilms Order No. 70-27023

An analysis of scanning errors in holography when both the receiver and source are scanned. These errors affect the hologram resolution, magnification and image position. The analysis assumes the simulated velocity and position errors are random and normally distributed. The hologram resolution, magnification and image position are derived and the functions linearized to obtain the approximate variances and expected values. The law of propagation of errors is assumed valid in the analysis. Its proof is based on the assumption that the errors are small with respect to the measured values of the variables. The maximum deviation from the expected value is assumed never to exceed 10%. The approximate variance, standard deviation and expected value are derived for the hologram resolution using both stationary and moving source illumination. The experimental results of the expected values of hologram resolution, magnification and image position agreed with predictions.
Dissert. Abstr.

N72-14696*# Structural Composites Industries, Inc., Azusa, Calif.
CRYOGENIC GLASS-FILAMENT-WOUND TANK EVALUATION Final Report
E. E. Morris and R. E. Landes Jul. 1971 300 p Prepared for Aerojet General Corp.
(Contract NAS3-10289)
(NASA-CR-72948) Avail: NTIS CSCL 20L

High-pressure glass-filament-wound fluid storage vessels with thin aluminum liners were designed, fabricated, and tested at ambient and cryogenic temperatures which demonstrated the feasibility of producing such vessels as well as high performance and light weight. Significant developments and advancements were made in solving problems associated with the thin metal liners in the tanks, including liner bonding to the overwrap and high strain magnification at the vessel polar bosses. The vessels had very high burst strengths, and failed in cyclic fatigue tests by local liner fracture and leakage without structural failure of the composite tank wall. The weight of the tanks was only 40 to 55% of comparable 2219-T87 aluminum and Inconel 718 tanks.
Author

N72-14697*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CALCULATION OF ELECTROMAGNETIC FIELDS IN THE FRESNEL AND FRAUNHOFER REGIONS USING NUMERICAL INTEGRATION METHODS
Richard F. Schmidt Jul. 1971 47 p refs Submitted for publication
(NASA-TM-X-65779; X-811-71-392) Avail: NTIS CSCL 20C

Some results obtained with a digital computer program written at Goddard Space Flight Center to obtain electromagnetic fields scattered by perfectly reflecting surfaces are presented. For purposes of illustration a paraboloidal reflector was illuminated at radio frequencies in the simulation for both receiving and transmitting modes of operation. Fields were computed in the Fresnel and Fraunhofer regions. A dual-reflector system (Cassegrain) was also simulated for the transmitting case, and fields were computed in the Fraunhofer region. Appended results include derivations which show that the vector Kirchhoff-Kottler formulation has an equivalent form requiring only incident magnetic fields as a driving function. Satisfaction of the radiation conditions at infinity by the equivalent form is demonstrated by a conversion from Cartesian to spherical vector operators. A subsequent development presents the formulation by which Fresnel or Fraunhofer patterns are obtainable for dual-reflector systems. A discussion of the time-average Poynting vector is also appended. Author

N72-14698*# Techtran Corp., Glen Burnie, Md.
SOUNDPROOFING AND FILLING IN OF ENGINES
J. Rauch Washington NASA Dec. 1971 147 p refs Transl. into ENGLISH of "Insonorisation et Remplissage des Moteurs", Min. de l'Air, Paris, report Rept-418
(Contract NASw-2037)
(NASA-TT-F-14063; Rept-418) Avail: NTIS CSCL 20A

The acoustic principles are presented for attenuating automobile engine noise. The various aspects of soundproofing exhaust noise are discussed, along with the means for low pitch sound absorption. A terminal reflection muffler system for total noise suppression is described. An admittance type muffler is also considered, and the requisite dynamic and acoustic conditions for its use are determined. Different materials are proposed for use as sound absorbers and the case of acoustic supercharging and optimization is studied. Author

N72-14699# Lockheed Missiles and Space Co., Palo Alto, Calif.
NEAR FIELD SOUND PRESSURE AND VIBRATIONAL VELOCITY IN PLANE WAVE SCATTERING BY A CIRCULAR CYLINDER
A. I. Kartavenko, V. A. Kirshov, and O. S. Tonakanov [1971] 7 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. (Moscow), no. 4, 1971 p 376-382

Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The amplitude configuration of the total sound pressure field and vibrational velocity components is computed theoretically for plane wave scattering by acoustically soft and hard cylinders. Results are presented of experimental investigations of the near field at a finite cylinder with soft boundaries in a water medium for kr = 1 - 8. The experimental and theoretical data are compared. Autnor

N72-14700*# Scientific Translation Service, Santa Barbara, Calif.
STUDIES OF COHERENT AND INCOHERENT STRUCTURES OF NOISE OF AERODYNAMIC ORIGIN
J. DeBelleval, P. Harel, J. Lambourion, and M. Perull Washington NASA Dec. 1971 8 p refs Transl. into ENGLISH of "Etude des Structures Coherentes et Incoherentes de Bruit d'Origine Aerodynamique", ONERA report ONERA-TP-983 Presented at 7th Intern. Congr. on Acoustics, Budapest, 1971
(Contract NASw-2035)
(NASA-TT-F-14091; ONERA-TP-983) Avail: NTIS CSCL 20A

With the aid of theoretical models currently in use, the coherent and incoherent structures of noise spectra of compressors are presented. The near pressure field of a compressor and the infrared emission of a hot jet are analyzed using spatial and temporal correlations in order to derive the structures of the sources. Author

N72-14701*# Scientific Translation Service, Santa Barbara, Calif.
A CONTINUOUS-GROUP CONCEPTION OF REDUNDANCY IN OBJECT IMAGES
V. S. Fayn Washington NASA Aug. 1971 8 p refs Transl. into ENGLISH of "Nepreryvno-Gruppovaya Kontseptsiya Izbytochnosti v Izobrazheniyakh Obyektov" in "Chetverty Simpozium po Probleme Izbytochnosti v Informatsionnykh Systemakh" Leningrad, Acad. of Sci., (USSR), 1970 p 581-590
(Contract NASw-2035)
(NASA-TT-F-13877) Avail: NTIS CSCL 20F

A method is described for constructing automatic algorithms. The method was tested for real materials using a sequence of frames of several motion picture films. Author

N72-14702*# Techtran Corp., Glen Burnie, Md.
ELECTRON-OPTICAL CYLINDER LENS ACTION OF THE STRAY FIELDS OF A CONDENSER
Richard Herzog Washington NASA Jul. 1971 18 p refs Transl. into ENGLISH from Phys. Z. (Leipzig), v. 41, 1940 p 18-26
(Contract NASw-2037)
(NASA-TT-F-13863) Avail: NTIS CSCL 20F

Deflection in the stray field of a condenser where the field is limited by a stop is computed and compared with that of a homogeneous substitution field. In both cases the axis beam is sharply deflected to the same degree if the substitution field overlaps the condenser plates by the distance sigma. The length of the substitution field can also be taken for screened magnetic fields, providing that the magnetization of the iron is sufficiently short of saturation. Rays which do not pass the stray field in the axis are deflected differently from those in the substitution field. Since this additional angle of deflection delta alpha is proportional to the distance from the axis, the activity of the stray field can be described through a thin lens. Author

N72-14703*# Georgia Inst. of Tech., Atlanta.
BEHAVIOR OF NOZZLES AND ACOUSTIC LINERS IN THREE DIMENSIONAL ACOUSTIC FIELDS Quarterly Report, 1 Sep. - 30 Nov. 1971
Ben T. Zinn, W. A. Bell, B. R. Daniel, and Allan J. Smith, Jr. 30 Nov. 1971 41 p ref
(Grant NGL-11-002-085)
(NASA-CR-121070) Avail: NTIS CSCL 20A

Theoretical values of the admittances of various nozzles were computed and compared with the corresponding experimental values. The existing data reduction scheme was corrected and all available experimental data has been rechecked and corrected whenever necessary; the updated experimental admittance values are presented. An analysis associated with the frequency sensitivity of experimental admittance values was initiated and the analog-to-digital Data Reduction Program which has become operational is discussed. Fourteen nozzle tests were conducted during this report period. Author

N72-14704*# Techtran Corp., Glen Burnie, Md.
VISUALIZATION OF PHASE OJECTS BY HILBERT TRANSFORM
Y. Belvaux and J. C. Vareille Washington NASA Jan. 1972 35 p refs Transl. into ENGLISH from Nouv. Rev. Opt. Appl. (France), v. 2, no. 3, May-Jun. 1971 p 149-162
(Contract NASw-2037)
(NASA-TT-F-14046) Avail: NTIS CSCL 20F

The Hilbert transform allows small phase shifts to be clearly exhibited. The properties are studied of images obtained by Hilbert transform and also their development as a function of different experimental parameters. The Hilbert transform is obtained by placing a 'phase knife' in the spectral plane of a double diffraction setup. In addition, the precision is examined with which the phase knife must be placed and centered in the spectral plane and the effect of width of source used. Experimental results are provided confirming the theoretical study. Author

N72-14705# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NEW METHOD OF SPECTRAL ANALYSIS
J. Max 27 Jul. 1970 33 p refs In FRENCH Presented at the 6th Intern. Congr. on Cybernetics, Namur, Belgium, 7-11 Sep. 1970
(CEA-Conf-1640; Conf-700932-1) Avail: AEC Depository Libraries

Three methods for the measurement of the energy spectral density are described. The measurement procedures used in the filtration method and Fourier transformation of the signals are discussed. Spectral analysis by correlation is considered in great detail, and the means of implementing this method are discussed. Two examples of the use of this third method are given. NSA

N72-14706# Sandia Labs., Albuquerque, N.Mex.
AN NDT INVESTIGATION OF THE BEHAVIOR OF ACOUSTIC EMISSION FROM A BRAZED METAL TO CERAMIC BOND
John H. Gieske [1971] 19 p refs Presented at the 6th Ann. ISA Conf. and Test Meas., Chicago, 4 Oct. 1971
(SC-DC-713903; Conf-711003-1) Avail: NTIS

The bond under investigation is made by brazing the metal electrodes of a voltage insulator tube onto the ends of a ceramic cylinder. The behavior of acoustic emission from the bond as the bond is put under stress is used as nondestructive testing technique. A significant difference in the acoustic emission behavior of different bonds was found. Both large amplitude bursts and small amplitude bursts were exhibited with the greatest total count being 160. The larger bursts were characteristic of a large area of failure while the small bursts represented insignificant failures which caused no significant overall weakening of the bond. Some bonds exhibited very little acoustic emission bursts until catastrophic failure of the bond. In most cases, such bonds also had the highest ultimate strengths. Author

N72-14707# Oak Ridge National Lab., Tenn.
THREE-DIMENSIONAL FINITE ELEMENT ANALYSIS OF THICK-WALLED VESSEL-NOZZLE JUNCTIONS WITH CURVED TRANSITIONS

N. Krishnamurthy Jul. 1971 113 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3315) Avail: NTIS

A preliminary study of the stress concentration phenomenon in the transition region of thick walled cylindrical-vessel nozzle junctions with curved transitions, using a three dimensional finite element computer program is described. Mathematical relationships necessary to define the geometrical configuration of the surfaces of the junction are derived. A three dimensional finite element mesh is proposed, and a computer program presented for automatic generation of such mesh. Principles of three dimensional finite element analysis, and principal features of a three dimensional finite element computer program, are briefly outlined. The application of the computer programs to the idealization and analysis of a typical vessel nozzle junction is described, and the results are discussed. Author (NSA)

N72-14708# Army Foreign Science and Technology Center, Charlottesville, Va.
MULTIPLE RANGE LIGHT MODULATOR FOR LIGHT RANGE FINDERS
I. I. Adryanova, V. B. Volkonskii, and Yu. V. Popov 21 Jul. 1971 7 p refs Transl. into ENGLISH from Opt.-Mekh. Prom. (USSR), v. 37, no. 2, 1970 p 74-75
(AD-728704; FSTC-HT-23-816-71) Avail: NTIS CSCL 20/6

The combination of Super High Frequencies (SHF) and low frequency light modulators is achieved by isolating a small sector of the waveguide or the end wall of the resonator in the SHF line (waveguide or cavity resonator) which contacts the electro-optical modulating element from the remainder of the SHF line using a dielectric disk with low losses at SHF, for example a ring of Teflon. With this design, the bias voltage for selection of the working point of the modulator, as well as the modulating low frequency voltage can be fed to the isolated sector of the SHF line. Author (GRA)

N72-14709# Hamilton Standard, Windsor Locks, Conn.
NOISE DETECTABILITY PREDICTION METHOD FOR LOW TIP SPEED PROPELLERS Final Report, 1 May 1970 - 1 May 1971
F. W. Barry and Bernard Magliozzi Wright-patterson AFB, Ohio AFAPL Jun. 1971 192 p refs
(Contract F33615-70-C-1583; AF Proj. 3066)
(AD-729432; HSER-5834; AFAPL-TR-71-37) Avail: NTIS CSCL 20/1

Experience in the field of quiet aircraft for reconnaissance/surveillance applications indicated a need for a reliable quiet propeller design procedure. The report describes the development of a computer program intended to fulfill this need. The propeller noise detectability computer program predicts propeller harmonic rotational noise using non-steady blade loads and broad-band noise using a new integration method and compares these predictions with an appropriate aural detectability criterion to estimate the minimum undetectable flight altitude. Supporting tasks include development of aural detectability criteria, a theoretical study of the effect of airfoil section shape on vortex noise, static noise tests of several propeller configurations, correlation of unsteady blade loads corresponding to measured harmonic noise levels, design and testing of a new quiet propeller, and a propeller noise detectability trend study.
Author (GRA)

N72-14710# Denver Research Inst., Colo. Div. of Mathematical Sciences.
EIGENFUNCTION EXPANSIONS AND SCATTERING THEORY FOR WAVE PROPAGATION PROBLEMS OF CLASSICAL PHYSICS
John R. Schulenberger and Calvin H. Wilcox Aug. 1971 91 p refs
(Contract N00014-67-A-0394-0002; NR Proj. 041-370)
(AD-729388; TSR-14; MS-R-7203; Rept-4423) Avail: NTIS CSCL 20/10

A unified description of wave propagation phenomena of classical physics is provided by a class of Schroedinger equations. An eigenfunction expansion is derived for functions in the subspace of continuity. The time-dependent theory of scattering for pairs of operators is used with eigenfunctions to derive the construction of the wave operators. Author

N72-14711# Tennessee Univ., Knoxville. Ultrasonics Lab.
ULTRASONIC WAVE GENERATION AND PROPAGATION Final Technical Report
M. A. Breazeale Aug. 1971 43 p refs
(Contract Nonr-4289(01); NR Proj. 384-306)
(AD-729410; TR-8) Avail: NTIS CSCL 20/1

The report covers four topics: (1) In Simplification of Apparatus to Diffract Light by Ultrasonic Waves, it is shown that the laser is ideally suited to such measurements because the laser beam is small, intense, and collimated, each of which simplifies measurements. (2) The next three chapters deal with various aspects of ultrasonic parametric oscillations, including the nonlinear equation which probably describes the situation. The use of parametric oscillations to make a variable frequency transducer has not been practical. On the other hand, measurement of the threshold of parametric oscillation does offer promise of a means of measuring relative attenuation. (3) Diffraction lobes from the beam pattern of transducers can be eliminated quite simply in certain cases. This technique is described in Chapters V and VI. The analogous techniques in optics is referred to as apodization. Therefore, it would be correct to refer to this ultrasonic technique as apodization of transducers. The final chapter shows the way the apodized transducers can be used to make a detailed study of the energy redistribution in an ultrasonic beam reflected from a liquid-solid interface at the angle at which surface waves are generated. Author (GRA)

N72-14712# Office of Naval Research, London (England).
SOME LOW TEMPERATURE RESEARCH AT THE UNIVERSITY OF ST. ANDREWS, UNIVERSITY OF LEICESTER AND UNIVERSITY OF NOTTINGHAM
Robert A. Hein 25 Aug. 1971 25 p refs
(AD-729639; ONRL-R-36-71) Avail: NTIS CSCL 14/2

The report describes research being carried out in Low Temperature Physics Programs at the University of St. Andrews, The University of Leicester, and the University of Nottingham. It is clear that research at ultralow temperatures (ULT) attainable by the use of dilution refrigerators is truly an exploding field of endeavor. In general the maintenance of these fridges and the associated problems of thermal contact at ULT present formidable tasks to the graduate student so that the actual running times accumulated on a given fridge is not too high. There is a shortage of graduate students and the new, spacious and well equipped research laboratories are not being utilized to the extent envisioned. Author (GRA)

N72-14713# Tennessee Univ., Knoxville. Ultrasonics Lab.
IMAGING OF FINITE AMPLITUDE ULTRASONIC WAVES BY BRAGG DIFFRACTION OF LIGHT
Franklin Douglas Martin Aug. 1971 16 p refs
(Contract N00014-71-A-0121-0001; NR Proj. 384-306)
(AD-729696; TR-9) Avail: NTIS CSCL 20/1

Light which has undergone Bragg diffraction by ultrasonic waves produces diffraction orders which actually contain images of the ultrasonic wavefront. This report includes observation and discussion of this first-order imaging. In addition, this report includes observation and discussion of higher order imaging which occurs when ultrasonic waves of finite amplitude are used. The conditions for dominance of Bragg diffraction over 'regular' diffraction are examined in relation to this higher order imaging, which is characterized by the appearance of multiple images in the higher diffraction orders. A transmission filter plate placed in the ultrasonic beam reveals that in addition to scattering and rescattering of light from the fundamental ultrasonic frequency, scattering of light from the second harmonic of the ultrasonic wave can be observed. The theory of Bragg diffraction of light by ultrasonic waves has been used to account for experimental

observations of first-order imaging. This theory has been extended to account for experimental observations in higher order imaging by relating it to multiple scattering of the light by the ultrasonic wave. Author (GRA)

N72-14714# Stanford Univ., Calif. Microwave Lab.
MICROWAVE RESEARCH Semiannual Status Report, 1 Dec. 1970 - 31 May 1971
Jun. 1971 81 p refs
(Contract N00014-67-A-0112-0039; NR Proj. 373-361)
(AD-730062; SU-ML-1973; SASR-4; Code-427) Avail: NTIS CSCL 20/1

The program is concerned with general research in electronics, involving materials having properties suitable for devices, with application to information processing, cryogenic power systems and biological instrumentation. Eight projects are included in the report: Tunable raman laser; Ring laser; Surface wave parametric systems; Monolithic surface wave amplifiers; Large time-bandwidth surface wave delay lines; Dielectric relaxation at low temperatures; Acoustic properties of materials; and Acoustic methods for cell discrimination. GRA

N72-14715# North Carolina Univ., Chapel Hill. Materials Research Center.
RESEARCH ACTIVITIES IN THE FIELD OF MATERIALS SCIENCE Annual Technical Progress Report, 1 Jun. 1970 - 31 May 1971
31 May 1971 140 p refs
(Contract DAHC15-67-C-0223)
(AD-729734) Avail: NTIS CSCL 11/7

The report gives very brief summaries of active research projects in chemistry, dentistry, geology, and physics carried out from June 1970 to May 1971 at the University of North Carolina, Chapel Hill. GRA

N72-14716# Air Force Cambridge Research Labs., Bedford, Mass.
THE ELECTROSTATIC POTENTIAL INSIDE A HEMISPHERE: ITS USE AS AN ELECTRON ENERGY ANALYZER AND AS A TRIODE ELECTRONIC DEVICE Physical Sciences Research Papers
A. R. Frederickson, J. R. Jasperse, and Neil Grossbard 23 Jun. 1971 54 p refs
(DASA Proj. 5710)
(AD-729926; AFCRL-71-0369; AFCRL-PSRP-458; Subtask-TA040; DoD-Element-61102H) Avail: NTIS CSCL 20/3

A method for obtaining a desired radar scattering pattern by reactively loading a conducting body is given. The theory uses the concept of characteristic modes of a loaded body. Any desired real current can be resonated by reactive loads to make it the dominant mode current of that body. If no other mode is near resonance, the radar scattering pattern becomes nearly the same as the radiation pattern of the resonated current. A quality factor Q is defined as a measure of the broadband behavior of a scatterer. Procedures for computing the real currents having a minimum Q, and maximum gain-quality ratio, are given. A pattern synthesis procedure is developed for obtaining the real current whose radiation field pattern is the least mean square approximation to a desired field pattern. The use of lumped loads to approximate continuous loading is also considered. Numerical examples and computer programs are given for each procedure discussed. Author (GRA)

N72-14717# Stanford Univ., Calif. Electronics Labs.
[PLASMA PHYSICS AND ELECTRONICS ENGINEERING] Semiannual Status Report, 1 Jan. - 31 Jul. 1971
31 Jul. 1971 110 p refs
(Contract N00014-67-A-0112-0044)
(AD-730055; SU-SEL-71-029; SU-SASR-120) Avail: NTIS CSCL 14/2

The progress of research in the following areas is summarized: Plasma physics and quantum electronics; Radioscience; Integrated circuits; Solid state; Information systems; Digital systems; Outside publications; Abstracts of reports published during the quarter. GRA

N72-14718# Naval Research Lab., Washington, D.C. Quantum Optics Branch.
OPTICAL WAVEGUIDES AND INTEGRATED OPTICS TECHNOLOGY Interim Report
R. A. Andrews 20 Aug. 1971 34 p refs
(RR Proj. 002-07-41-5064)
(AD-730438; NRL-7291) Avail: NTIS CSCL 20/12

An introduction is given to the optical waveguide and integrated optics technology with emphasis on potential application in Navy systems. The fundamentals of optical waveguides are presented, as well as a discussion of their important characteristics. A description of all the waveguide passive and active devices that have been demonstrated is given. Areas where new devices are possible are also discussed. This discussion includes optical waveguides, passive optical elements, couplers, lasers and amplifiers, modulators, deflectors, detectors, nonlinear devices, and input and output couplers. The application of these devices to integrated optical systems for communications, display, and computers is discussed. Conclusions are drawn about the future growth of this technology in light of the current potential and the important problem areas. Author (GRA)

N72-14719# Yale Univ., New Haven, Conn. Dept. of Physics and Applied Science.
LOW TEMPERATURE PHYSICS Final Report, 1 Aug. 1963 - 31 Jan. 1971
Cecil T. Lane 27 Aug. 1971 5 p
(Contract DA-31-124-ARO(D)-126; DA Proj. 200-61102-B-11-B)
(AD-730782; AROD-4176-4-P) Avail: NTIS CSCL 20/13

A variety of problems in low temperature physics have been studied, these falling mostly in the area of superfluidity in liquid helium and also in the field of superconductivity and solid state physics. This report lists those problems which have been investigated and brought to publishable conclusion. Author (GRA)

N72-14720# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROMAGNETIC FIELDS IN RESONATORS WITH FLUCTATING BOUNDARY
V. N. Krasilnikov and A. M. Pankratov 12 Jul. 1971 41 p refs Transl. into ENGLISH from Probl. Difraktsii i Rasprostraneniya Voln (USSR), no. 8, 1968 p 59-84
(AD-729961; FTD-MT-24-100-71) Avail: NTIS CSCL 20/6

A comprehensive analysis is presented on the behavior of electromagnetic field oscillations in a closed resonator whose walls fluctate according to a known law. The simplest model, two-plane-parallel reflective walls, one of which undergoes certain fluctuations in a direction perpendicular to both planes, is considered in this first part of the work, with a view to investigating the basic conditions of building up oscillations from certain initial conditions by the recurrent interaction of the initial waves with the wall fluctuations. Also, the effects of wall fluctuations on the wave characteristics are considered under conditions excluding build-up or generation. An ideal case is considered and all factors are neglected which affect the results under real conditions (properties of the medium, dispersion of resonator characteristic, field components depending on coordinates other than those perpendicular to the walls, etc.). Losses due to wall imperfections as reflectors are expressed through diminished reflectivity of the stationary wall. The fundamental solutions are derived from Maxwellian field equations according to the D'Alembert method. Author (GRA)

N72-14721# Maryland Univ., College Park. Dept. of Electrical Engineering.
THE STUDY OF THE INTERACTION OF INTENSE

PICOSECOND LIGHT PULSE WITH MATERIALS. BERG-BARRETT X-RAY OBSERVATION OF ANNEALING AND LASER INDUCED DAMAGE TO ZINC Quarterly Technical Report, 22 Mar. - 21 Jun. 1971

Chi H. Lee, Carl Cm. Wu, and Ronald W. Armstrong 21 Jul. 1971 25 p refs See also rept. AD-727755, 18 Dec. 1970
(Grant DA-ARO(D)-31-124-71-G55; ARPA Order 675-Am-9)
(AD-729939; Code-9E20) Avail: NTIS CSCL 20/12

The Berg-Barrett X-ray diffraction contrast technique has been utilized to study the process of laser induced damage in a zinc crystal, and also to make observations on the annealing characteristics of the dislocation substructure before and after the laser treatment. Annealing caused individual dislocations to become segmented with various sections of their line lengths becoming parallel to <1010>. This preference for a crystallographic orientation of the dislocations seemed related to the equally important observation that the subboundary lineage structure of the crystals was also largely composed of tilt boundaries of (1010) and (1120) surfaces. The laser induced damage required a threshold energy which caused melting, possible vaporization and appreciable plastic deformation of the matrix material by deformation winning, non-basal slip and micro-kinking. By comparison with the structural rearrangement observed in the pre-annealed specimen, the laser damage zone showed only very retarded changes. Author (GRA)

N72-14722# Woods Hole Oceanographic Institution, Mass.
MODIFIED RAY THEORY IN THE PRESENCE OF A BOUNDARY

J. A. Davis and E. L. Murphy Jul. 1971 21 p refs Presented at 81st Meeting of Acoust. Soc. of Am., Washington, D.C., 20-23 Apr. 1971
(Contract N00014-70-C-0205)
(AD-730701; WHOI-Ref-71-48; Paper-3) Avail: NTIS CSCL 20/1

The modified ray theory based on Generalized WKB solutions to a two turning point problem for an unbounded medium having a maximum in sound velocity has been extended to include a pressure release surface and rigid boundary at the maximum. This modified ray theory, unlike ordinary ray theory, predicts a frequency dependent phase change which varies continuously for the transition from normal incidence rays to rays which reverse far from the boundary. The behavior of this phase, and in turn its derivative, gives rise to a frequency dependent beam displacement for ray bundles. The results have the same form as for the unbounded problem but with an additional important contribution. These beam displacement phenomena can have the consequence of introducing caustics or convergence zones where none exist according to ordinary ray representations and distorting caustics and shadow zones in a frequency dependent way when they do exist in the ordinary ray picture. Numerical results for simple velocity profiles characteristic of the ocean indicate that these frequency dependent diffraction effects can be significant for frequencies on the order of 50 Hz.
Author (GRA)

N72-14723# Woods Hole Oceanographic Institution, Mass.
APPLICATION OF MODIFIED RAY THEORY TO UNDERWATER SOUND PROPAGATION

E. L. Murphy, J. A. Davis, and J. A. Doutt Jul. 1971 21 p refs Presented at the 81st Meeting of Acoustical Soc. of Am., Paper No. 4, Washington, D.C., 20-23 Apr. 1971
(Contract N00014-70-C-0205)
(AD-730702; WHOI-Ref-71-49) Avail: NTIS CSCL 20/1

At frequencies of a few hundred Hertz or less, diffraction effects can be significant for sound propagation in the oceans. A modified ray representation for some of these effects has recently been developed. The method applies to propagation through regions of local sound-velocity maximum, and for rays reflected or refracted away from a boundary region with velocity profile monotonically decreasing away from the boundary. In this paper, velocity profiles are considered, varying only with depth, composed of nearly linear and nearly parabolic segments joined with continuous derivative. In this way, modified ray analysis covers a wide class of realistic profiles pertinent to underwater sound propagation. Modified ray analysis is most conveniently formulated as wavelength-dependent ray displacement and leakage phenomena. Ranges for displaced rays (at given receiver depth) versus ray parameter (angle at source) are presented for unbounded examples and for profiles bounded by pressure release or rigid surfaces. Leakage coefficients are included for the unbounded examples. Unlike ordinary ray representations, modified rays are not sensitive to small changes in profile. Author (GRA)

N72-14724# California Inst. of Tech., Pasadena.
ACTIVE INTEGRATED OPTICS

Ammon Yariv Aug. 1971 46 p refs
(Contract DAHC04-68-C-0041)
(AD-730358; TR-1-71) Avail: NTIS CSCL 20/6

The authors consider the problem of guiding light in thin dielectric films and that of actively interfering with the power of flow in the modes by means of the electro-optic and photoelastic effect. A review of the current state of the art and the potentialities suggested by theoretical considerations suggest that the basic functions of light generation, switching, guiding, and detection can be performed in a single monolithic material.
Author (GRA)

N72-14725# California Univ., San Diego. Visibility Lab.
UNDERWATER LIGHTING BY SUBMERGED LASER AND INCANDESCENT SOURCES Final Report

Seibert Q. Duntley Jun. 1971 293 p refs
(Contract N00014-69-A-0200-6013)
(AD-730721; SIO-Ref-71-1) Avail: NTIS CSCL 13/1

Underwater lighting at virtually all distances (including long ranges) produced by submerged lasers (pulsed and continuous) was measured on-axis and at off-axis angles out to 90 degrees in seven types of water. All of these data are summarized by a single closed form equation for engineering use. Computer studies using this equation have extrapolated the data to other types of water. The equation can predict the performance of submerged lasers operating at any wavelength. Methods for measuring the applicable optical constants of natural waters are described. Techniques for long-range underwater photography using conventional light sources are illustrated and supplemented by engineering equations. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-14726 Northwestern Univ., Evanston, Ill.
RADIATIVE LIFETIMES OF UV MULTIPLETS IN ATOMIC CARBON, NITROGEN AND OXYGEN Ph.D. Thesis

Robert Bryce Hutchison 1970 135 p
Avail: Univ. Microfilms Order No. 71-1875

Eleven multiplets in the spectral region 916 to 1742 of carbon, nitrogen, and oxygen were measured using a modification of the phase shift technique. Excitation of the emission was accomplished by the impact of 200 eV electrons with molecular gases containing the atom of interest. The electron beam was sinusoidally modulated at eight logarithmically spaced radio frequencies, ranging from .55 to 28.0 MHz. The phase delay of the sinusoidally varying photon output was measured by comparsion with a calibrated, variable delay line to determine the radiative lifetimes. Six of the multiplets were found to exhibit cascading effects, and corrections for these effects were obtained by the application of a one-level cascade model. The measured liftimes ranged from 0.6 to 9.9 nanoseconds, with estimated accuracies of 10 to 15%. Dissert. Abstr.

N72-14727*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE STOPPING RATE OF NEGATIVE COSMIC-RAY MUONS NEAR SEA LEVEL
G. Spannagel and E. L. Fireman Dec. 1971 18 p refs
(Grant NGR-09-015-145)
(NASA-CR-115311; SAO-111-098) Avail: NTIS CSCL 20H

A production rate of 0.065 + or - 0.003 Ar-37 atom/kg min of K-39 at 2-mwe depth below sea level was measured by sweeping argon from potassium solutions. This rate is unaffected by surrounding the solution by paraffin and is attributed to negative muon captures and the electromagnetic interaction of fast muons, and not to nucleonic cosmic ray component. The Ar-37 yield from K-39 by the stopping of negative muons in a muon beam of a synchrocyclotron was measured to be 8.5 + or - 1.7%. The stopping rate of negative cosmic ray muons at 2-mwe depth below sea level from these measurements and an estimated 17% electromagnetic production is 0.63 + or - 0.13 muon(-)/kg min. Previous measurements on the muon stopping rate vary by a factor of 5. Our value is slightly higher but is consistent with two previous high values. The sensitivity of the Ar-37 radiochemical method for the detection of muons is considerably higher than that of the previous radiochemical methods and could be used to measure the negative muon capture rates at greater depths. Author

N72-14728*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEFORMED BRUECKNER-HARTREE-FOCK CALCULATION FOR LIGHT NUCLEI
R. C. Braley, W. F. Ford, R. L. Becker (Oak Ridge Natl. Lab.), and M. R. Patterson (Oak Ridge Natl. Lab.) 1971 20 p refs Presented at Am. Phys. Soc. Meeting, Tucson, Ariz., 4-6 Nov. 1971
(NASA-TM-X-67972; E-5503) Avail: NTIS CSCL 20H

For the first time the Brueckner-Hartree-Fock (BHF) method was applied to nuclei whose intrinsic structure is nonspherical. One aim was to investigate whether the energy dependent reaction matrix calculated from a realistic nucleon-nucleon interaction leads to deformations similar to, or different from, those obtained from energy independent interactions in Hartree-Fock (HF) calculations. Reaction matrix elements were calculated as a function of starting energy for the Hamada-Johnston interaction, using a Pauli operator appropriate to O-16 and a shifted oscillator spectrum for virtual excited states. Binding energies, single-particle energies, radii, and shape deformations of the intrinsic state in unrenormalized as well as renormalized BHF are discussed and compared with previous HF studies. Results are presented for C-12, O-16, and Ne-20.
Author

N72-14729*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMMENTS ON "CONTACT DIFFUSION INTERACTION OF MATERIALS WITH CLADDING"
James F. Morris Washington Jan. 1972 14 p refs
(NASA-TM-X-2423; E-6538) Avail: NTIS CSCL 18H

A Russian paper by A. A. Babad-Zakhryapina contributes much to the understanding of fuel, clad interactions, and thus to nuclear thermionic technology. In that publication the basic diffusion expression is a simple one. A more general but complicated equation for this mass transport results from the present work. With appropriate assumptions, however, the new relation reduces to Babad-Zakhryapina's version. Author

N72-14730# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
TWO-PHOTON CONTRIBUTION TO THE PRODUCTION OF SPIN TWO HADRONS IN THE POSITRON ELECTRON ANNIHILATION CHANNEL
John Dooher and Alan J. Stewart (Bradford Computer and Systems, Inc.) Jan. 1972 14 p refs Presented at Meeting of the Div. of Particles and Fields, Am. Phys. Soc., Rochester, N. Y., 30 Aug. - 2 Sep. 1971
(RM-529J) Avail: NTIS

The cross section for the process e(+) + e(-) yields f(0) is calculated and shown to be two orders of magnitude smaller than was previously estimated. The angular distribution is correctly determined, and a comparison is made with other processes in which the f(0)2 gamma vertex occurs, notably the double bremsstrahlung process e(+) + e(-) yields e(+) + e(-) + f(0). Possible experimental consequences are discussed. It is also shown that a direct coupling of the electromagnetic stress tensor and the f(0) field is consistent with the vector dominance model.
Author

N72-14731*# Stanford Research Inst., Menlo Park, Calif.
THEORETICAL STUDIES OF IONIC AND ATOMIC IMPACT PHENOMENA Final Report, 1 Jan. - 31 Dec. 1971
Ronald E. Olson and Felix T. Smith 23 Dec. 1971 45 p refs Supported in part by DASA
(Contract NASw-2172; SRI Proj. PYU-1277)
(NASA-CR-125060) Avail: NTIS CSCL 20H

An absorbing sphere model based on the Landau-Zener method was developed for calculating the energy dependence of the total cross sections for the reaction A(+) + B(-) yields A star + B + Delta E, in which A or B may be atomic or molecular species. It was found that the cross sections were highly dependent on the electron detachment energy of B(-). The ionization total cross sections for Ne star (2p5 3s 3P) + Ar were calculated over a large energy range and compared with experiments. Author

N72-14732# Grumman Aerospace Corp., Bethpage, N.Y. Nuclear and Astrophysics Section.
LUMINESCENCE YIELD IN ROENTGENOGRAPHY WITH HIGH-ENERGY X-RAYS
Werner Brandt (New York Univ.) and Michael C. Stauber Jan. 1972 6 p refs Presented at the IEEE 1971 Nucl. Sci. Symp., San Francisco, 3-5 Nov. 1971
(RM-531J) Avail: NTIS

A universal energy transfer function is derived that applies to absorption of X-rays or gamma rays in all thin (less than about 3g/sq cm) luminescent screens over a wide range of incident energies. This function is evaluated for monoenergetic incident radiation and for bremsstrahlung originating in gold targets. A scaled universal luminescence yield is given, in terms of the energy transfer function minus an energy escape function which accounts for energy loss by electron escape from the phosphor. Under conditions of small energy escape, the dominant dependence of the luminescence yield on the phosphor appears only as a multiplicative material characteristic constant. Author

N72-14733*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DETERMINATION OF THE CHARGE OF RELATIVISTIC HEAVY NUCLEI FROM EMULSION TRACKS
S. H. Morgan, Jr. and P. B. Eby 11 Aug. 1971 16 p refs
(NASA-TM-X-67467; MISC-SSL-71-4) Avail: NTIS CSCL 20H

The number of delta rays with energies between 50 and 150 keV that are produced by heavy nuclei in emulsions is calculated. The Z(2) dependence predicted by the first Born approximation is corrected by a direct calculation of the Mott exact phase-shift scattering cross section. Comparisons are made with corrections predicted by the second Born approximation. When the phase-shift results are applied to the problem of charge identification, corrections of up to 4 units of charge for 1.457-GeV/nucleon nuclei with charge Z = 75 are found.
Author

N72-14734# Joint Publications Research Service, Washington, D.C.
ELECTRONIC ANALOG OF N. I. KOBOZEV'S PSYCONS IN NEURISTORS
S. A. Kutolin 7 Jan. 1972 4 p refs Transl. into ENGLISH

from Elektron. Tekhn. (Moscow), Ser. 12, v. 7, no. 1, 1971 p 127-129
(JPRS-54877; CSO-0575/72-W; UDC-536.75) Avail: NTIS

An analysis is presented of entropy states based on a Fermi gas model in a low entropy apparatus with the capability of less than one error per 1000 operations. It is shown that neuristor-like elements consititute an electronic analog of psycons which explains the function mechanism of the neuristor element, i.e., the transmission of information with low noise. The entropy of the neuristor in the conducting state (on) is smaller than in the nonconducting state (off). F.O.S.

N72-14735# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE MATTER-ANTIMATTER PHASE TRANSITION: A DERIVATIVE OF THE CRITICAL TEMPERATURE
R. Aldrovandi and S. Caser Sep. 1971 10 p refs
(LPTHE-71/47) Avail: NTIS

A new estimate of the temperature of the matter-antimatter phase transition in the black-body radiation is given using the theoretical nucleon-antinucleon phase-shifts computed in a previous work. Author

N72-14736# Atomic Energy Commission, New York. Health and Safety Lab.
FALLOUT PROGRAM Quarterly Summary Report, 1 Mar. - 1 Jun. 1971
Edward P. Hardy, Jr. 1 Jul. 1971 311 p refs
(HASL-243) Avail: NTIS HC $6.00/MF $0.95

Abstracts are presented on: (1) Health and Safety Laboratory (HASL) Fallout Program; (2) HASL inventories of seasonal distributions of excess C-14 from March 1955-July 1969; (3) worldwide deposition of Sr-90 through 1970; (4) Sr-90 in human bones; and (5) Cs-137 content of components of human diets in Chicago during April 1971. A.L.

N72-14737# Technische Hochschule Darmstadt (West Germany).
ISOTOPE GENERATORS: NEW DEVELOPMENTS, IMPROVEMENTS, TESTING OF COMMERCIAL GENERATORS Final Report, 1 Oct. 1966 - 30 Sep. 1969
H. Bernhard and K. H. Lieser 22 Dec. 1970 107 p refs In GERMAN
(EUR-4619) Avail: AEC Depository Libraries

The following commercial generators were subjected to long-term tests: I-132 generator, Sr-87m generator, and Tc-99m generator. The claims of the construction firm with regard to the operational safety and purity of the daughter nuclides were confirmed. Only in prolonged service was there, to some extent, an appreciable decline in the performance of the generators. In addition, the processes described in the literature for obtaining the following radionuclides were studied in more detail: Y-90, Ba-137m, In-115m, La-140. With certain improvements and precautions, the use of these processes seems possible in order to obtain the above-mentioned radionuclides in isotope generators, at least for limited operating times. Author (NSA)

N72-14738# Oak Ridge National Lab., Tenn.
COMPILATION OF UNITED STATES NUCLEAR STANDARDS 7TH EDITION, 1970
Jun. 1971 189 p
(Contract W-7405-eng-26)
(ORNL-NSIC-85) Avail: NTIS

All United States Nuclear Standards activities known to the Special Committee of the Nuclear Technical Advisory Board are presented in simple tabular form. The pertinent technical, industrial, and environmental organizations are listed alphabetically and the standards activities are given for each. In addition to approved standards, unapproved drafts and proposed activities are also listed when the information is available. In the United States, the most concerted standards efforts are channeled through the American National Standards Institute. The nuclear standards effort of many organizations, including several of those listed who also conduct some independent activities, are represented in the standards program of the American National Standards Institute. Author (NSA)

N72-14739# California Univ., La Jolla. Dept. of Chemistry.
ON THE VALIDITY OF STOCHASTIC RATE EQUATIONS IN FINITE SYSTEMS WITH FINITE STRENGTH INTERACTIONS
Robert I. Cukier, Kurt E. Shuler, and John D. Weeks Aug. 1971 27 p refs
(Contract N00014-69-A-0200-6018; ARPA Order 1479)
(AD-729260; TR-8) Avail: NTIS CSCL 07/4

Starting with the Hamiltonian for a linear harmonic chain of 2N particles of mass m and one of mass M, numerical calculations were carried out for the momentum autocorrelation function of the mass defect particle for chains with finite number N of mass points and for nonzero values of the mass ratio mu = m/M. These results were compared with the exponential relaxation of the momentum autocorrelation function. This last is the result of the calculations when approaching the thermodynamic and weak coupling limit. At these limits the dynamics of the mass defect particle is exactly described by a Fokker-Planck equation, a stochastic equation of motion. An exponential relaxation of the momentum autocorrelation function is obtained, to an excellent approximation, for mass ratios as high as mu = 0.1 and for chains with only 50 particles. Thus, for the harmonic chain considered, the stochastic equations of motion can be applied to an approximation more exact than the usual imposed thermodynamic and weak coupling limits. Author (GRA)

N72-14740# California State Coll., Long Beach. Dept. of Physics and Astronomy.
APPLICATIONS OF SEPARABLE NONLOCAL POTENTIALS TO PHYSICAL PROBLEMS Final Report
Bruce L. Scott 15 Aug. 1971 10 p refs
(Grant AF-AFOSR-1287-67; AF Proj. 9751-02)
(AD-730389; AFOSR-71-2390TR; Rept-6144501; Rept-681302) Avail: NTIS CSCL 20/8

Three separate lines of research were pursued here. First, it was shown that nonlocal nonHermitian separable potentials of the first rank could be made to have more than one bound state and also give a real phase shift which would change sign. However, these desirable properties were overbalanced by the non-orthogonality of the bound state wave functions and the lack of symmetry of the t-matrix. Second, techniques for calculating the t-matrix for hard core-local potential were developed and the matrix elements compared with a corresponding potential without the hard core. Attempts to represent the exact t-matrix by a two term separable expression were unsuccessful. Finally, the matrix elements relevant to the photodisintegration of the deuteron were calculated using the newly developed one-Boson-exchange potentials for the nuclear force. Author (GRA)

N72-14741# Naval Weapons Evaluation Facility, Albuquerque, N. Mex.
CDR: A PROGRAM TO CALCULATE CONSTANT DOSE RANGES FROM A POINT SOURCE OF RADIATION IN THE ATMOSPHERE
J. E. Campbell, S. A. Dupree, and M. L. Forsman 20 Jul. 1971 71 p refs
(AD-728747; NWEF-1081) Avail: NTIS CSCL 18/8

Constant Dose Range (CDR) is an altitude scaling code which calculates ranges of constant dose or fluence from a source of neutrons and/or photons in the atmosphere. It requires input fluxes obtained from radiation transport calculations in uniform sea-level air, and is specifically designed for use in conjunction with the one-dimensional S sub n code DTF-IV. CDR accepts data from coupled neutron-photon transport calculations which include secondary gamma production, and calculates the dose due to neutrons only, gamma rays only, or both simultaneously. Author (GRA)

N72-14742# California Univ., La Jolla. Dept. of Applied Physics and Information Science.
THE MEASUREMENT OF SPATIAL AND TEMPORAL DISTRIBUTION OF RADIATION, USING A TALBOT SPECTROMETER Annual Report No. 2
Adolf W. Lohmann and Donald E. Silva 30 Jun. 1971 55 p refs
(Contract F19628-69-C-0268; ARPA Order 1366)
(AD-730330; AFCRL-71-0358; AR-2) Avail: NTIS CSCL 17/5

A Simulation Game to train data processors in optimal data recovery techniques is included in this report. Also, the authors studied the triple-multiplexing response to a point source for a future scanning spectrometer. Three basic motions are required to modulate the wavelength and angular coordinates of the source. When performing preliminary experiments with the Multiplex Scanner, the authors discovered that the underlying Talbot effect is useful also for measuring phase objects. The theory of this new Talbot Interferometer is explored and experimental results of a candle flame are reported. For axially symmetric objects, this setup is modified by replacing the straight line gratings with circular gratings. In this way the radial gradient of the deformed wavefront is observed. Finally a means of simply, yet accurately collimating a light source using the Talbot Interferometer is described. Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-14743 Colorado State Univ., Fort Collins.
MICROWAVE REENTRY PLASMA DIAGNOSTICS Ph.D. Thesis
James Patrick Rybak 1970 241 p
Avail: Univ. Microfilms Order No. 71-2428

The use of microwave antennas for solving plasma diagnostic problems involved in communications with reentry vehicles is discussed. It was determined that the admittance of a thin, microwave aperture antenna, located on the surface of a reentry vehicle, can be used to obtain the values of the electron density, electron collision frequency, ion sheath thickness and electron temperature of the reentry plasma. It is further demonstrated, by using admittance measurements made during a reentry test flight, that open-ended-waveguide antenna admittances can be used to determine the plasma electron density, electron collision frequency and plasma standoff distance when the reentry plasma is separated, due to aerodynamic boundary layer effects, from the surface of the reentry vehicle. The reentry plasma values determined from waveguide antenna admittance measurements are shown to be consistent with those predicted by preflight, air-chemistry analysis. Dissert. Abstr.

N72-14744*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME EXPERIMENTAL OBSERVATIONS ON CIRCULATING CURRENTS IN A CROSSED FIELD PLASMA ACCELERATOR
J. Jedlicka and J. Haacker Dec. 1971 32 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in May 1972
(NASA-TM-X-67450) Avail: NTIS CSCL 20I

Experiments on a thermally ionized argon plasma suggest that applying a Lorentz force by means of orthogonal electric and magnetic fields to an electrically conducting fluid flow imposes necessary but not sufficient conditions for acceleration. There are, in fact, many combinations of current and magnetic field which cause decelerations of the fluid. The deceleration arises from a retarding force which may be larger than the applied Lorentz force. The retarding force causing the deceleration is a consequence of currents circulating completely within the fluid. These currents arise from differences in velocity between the central and wall regions of the duct which interact with the imposed magnetic field to produce differences in induced voltages. The observed physical effects of the circulating currents cause a loss in velocity in the central region of the duct, an increase in thermal energy in the sidewall region, and little change in thermal energy near the electrode wall region. For similar velocity profiles, the adverse effects appear to be related to the product of electrical conductivity and velocity, and performance as an accelerator appears to be controlled by the Hoffman loading parameter (i.e., the ratio of the applied to the induced currents). Author

N72-14745*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUASI-LINEAR THEORY OF ELECTRON DENSITY AND TEMPERATURE FLUCTUATIONS WITH APPLICATION TO MHD GENERATORS AND MPD ARC THRUSTERS
Marlin Smith 1972 16 p refs Presented at 10th Aerospace Sci. Meeting, San Diego, Calif., 17-19 Jan. 1972
(NASA-TM-X-67978; E-6660) Avail: NTIS CSCL 20I

Fluctuations in electron density and temperature coupled through Ohm's law are studied for an ionizable medium. The nonlinear effects are considered in the limit of a third order quasi-linear treatment. Equations are derived for the amplitude of the fluctuation. Conditions under which a steady state can exist in the presence of the fluctuation are examined and effective transport properties are determined. A comparison is made to previously considered second order theory. The effect of third order terms indicates the possibility of fluctuations existing in regions predicted stable by previous analysis. Author

N72-14746# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ION CYCLOTRON RESONANCE PLUGGING AND HEATING OF CUSPED PLASMAS
Shoji Miyake Oct. 1971 26 p refs
(IPPJ-111) Avail: NTIS

Ion cyclotron resonance plugging and heating of cusped plasma is experimentally investigated. A helium plasma is steadily fed from one of point cusps into the containment region whose density is varied from 1 x 10 to the 8th power to 1 x 10 to the 11th power cu/cm. With a plugging RF electric field of 100 V/cm, it is found that 97% of the line-cusp loss is blocked at the ion cyclotron resonance condition and that the mean energy of contained ions attained as large as 40 eV. For the line-cusp loss, good plugging is observed for the density up to 1 x 10 to the 11th power cu/cm, but for the point-cusp loss it is limited to the density below 1 x 10 to the 10th power cu/cm. Heating of ions by electrostatic ion cyclotron wave is calculated taking into account the role of the nonuniformity of the magnetic field, and the comparison with the experimental results is discussed. Author

N72-14747# Nagoya Univ. (Japan).
EXPERIMENTS OF PLASMA CONFINEMENT IN JIPP STELLARATOR. 2: CONVECTIVE MOTIONS DUE TO TRAPPED PARTICLES IN STELLARATOR FIELD
Kenro Miyamoto, Akihiro Mohri, Nobuyuki Inoue, Masami Fujiwara, and Kiyoshi Yatsu Oct. 1971 20 p refs
(IPPJ-110) Avail: NTIS

Dependences of plasma confinement on the properties of the stellarator field such as the rotational transform angle, shear, well depth, the magnitude B as well as the plasma parameters over a relatively wide range are studied using several kinds of plasma sources. The observed diffusion coefficients are 1/20 to about 1/30 times the Bohm coefficient. Convective motions of E x B drift due to the trapped particles at the corners of magnetic surface of the L = 3 stellarator are observed by measuring the distributions of the densities and potentials over the plasma cross section. The magnitude of the observed decay time tau and the scaling law of B and T sub e dependences of tau can be explained by the observed convective motions and the low frequency fluctuations observed in the boundary region. Author

N72-14748# Japan Atomic Energy Research Inst., Tokyo.
MEASUREMENTS OF CURRENT DENSITY DISTRIBUTIONS IN TOKAMAK-PLASMAS DUE TO AN ASYMMETRY IN A SCATTERED SPECTRUM
Funahashi Akimasa May 1971 7 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4437) Avail: AEC Depository Libraries

A method is proposed for measuring the current density distribution in a Tokamak apparatus. The principle of this method depends on the fact that the directed electron motion produces an asymmetry in the scattered spectrum of an electromagnetic wave when the scattering parameter alpha is larger than unity. When the direction of k equals k sub s minus k sub i(k sub s and k sub i are the scattered and incident wave vectors respectively) is parallel to the directed electron velocity due to a plasma current, the condition being considered becomes simple because the effect of the toroidal magnetic field is neglected in a scattered spectrum. The applicability of this method to the JFT-2 Tokamak apparatus is discussed. NSA

N72-14749# Academy of Sciences (USSR), Leningrad. Physical and Technological Inst.
WAVE TRANSFORMATION CONDITIONS IN LONGITUDINALLY INHOMOGENEOUS PLASMA
V. I. Arkhipenko, V. N. Budnikov, and A. A. OBukhov 1971 25 p refs In RUSSIAN; ENGLISH summary
(NP-18913) Avail: AEC Depository Libraries

Experimental results concerning the microwave transformation condition in inhomogeneous plasma are described. The plasma was produced by 10-cm microwaves in a uniform magnetic field configuration. The absorption region boundary was determined at different gas pressures. Its location corresponded to the theoretically calculated boundary for the wave transformation in one-dimensional plasma, assuming certain values for alpha, the angle between the density gradient and the magnetic field line direction. The angle was shown to be dependent only on the gas pressure. The transformation region was spatially localized near the minimum at the longitudinal density distribution and the plasma was characterized by the presence of infection points on the isodensity lines, in the vicinity of the density minimum. The dependence of the angle alpha in the transformation region on longitudinally inhomogeneous discharge parameters was found. Author (NSA)

N72-14750# Academy of Sciences (USSR), Leningrad. Fiziko-Tekhnicheskii Inst.
STUDY OF LOCATION OF WAVE TRANSFORMATION REGION IN ULTRAHIGH FREQUENCY DISCHARGE PLASMA
V. I. Arkhipenko, V. N. Budnikov, and A. A. Obukhov 1971 19 p refs In RUSSIAN; ENGLISH summary
(NP-18912) Avail: AEC Depository Libraries

Location of the wave transformation region in plasma formed by 10-cm microwaves was investigated. The experiments were carried out with magnetic fields lower and higher than the electron cyclotron field, which corresponds to high and medium frequency ranges of transformation. The plasma was obtained in a quartz tube 70 cm long and 2.5 cm in diameter, placed in a right-angle 10-cm waveguide. The operating gas was argon at 0.1 to 0.001 mm Hg. The location of the transformation region was determined by the small local perturbation of the magnetic field. The axial distribution of light emission was also measured. The characteristics of the location of the wave transformation region are discussed on the basis of wave transformation theory for two-dimensional plasma. Author (NSA)

N72-14751# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.
HIGH-DENSITY PLASMA CONFINEMENT IN POLOIDAL MAGNETIC FIELDS
B. Lehnert 14 Aug. 1971 56 p refs
(TRITA-EPP-71-18) Avail: NTIS

The theoretical background as well as obtained experimental results and future plans of the Swedish fusion research program are reviewed. The specific problems of high-density plasma confinement in internal ring and rotating plasma devices are treated, including plasma generation, plasma balance, confinement schemes, stability, plasma heating, plasma diagnostics, and part of the reactor technological problems involved. Author (ESRO)

N72-14752# Naval Research Lab., Washington, D.C.
A NOTE ON ELECTRON CURRENTS IN A MONOTONIC SHOCK WAVE
John B. McBride, W. M. Manheimer, and M. Lampe Jul. 1971 11 p refs
(NRL Proj. 77H02-27)
(AD-729253; NRL-MR-2318; DNA-Subtask-HC-04001) Avail: NTIS CSCL 20/9

It is shown that the electron current from the E x B drift is necessarily the dominant current in a monotonic cross-field shock wave in a plasma, regardless of Mach number or plasma beta. Author (GRA)

N72-14753# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Plasma Physics Research Lab.
PASSIVE FEEDBACK CONTROL OF A DRIFT TYPE INSTABILITY IN A Q-MACHINE PLASMA COLUMN
G. L. Mueller and R. S. Palmer May 1971 40 p refs
(AF Proj. 7073-00-04)
(AD-729444; ARL-71-0080; DoD-Element-61102F; DoD-Subelement-681301) Avail: NTIS CSCL 20/9

A passive feedback instability control, driven by the plasma instability itself, is applied to drift-type oscillations in a Q-machine. Instability amplification and partial suppression and a change of the equilibrium plasma density with the feedback controlled oscillation amplitude are measured. The passive feedback control mechanism can be described by the stationary solution of the Van der Pol differential equation for non-linear oscillation phenomena. The efficiency of the oscillation control was found to be small in this experiment because only a single feedback loop was applied. Various proposals are discussed in order to improve the stabilization efficacy of the passive feedback method and especially for an application to the collision-dominated drift instability. Author (GRA)

N72-14754# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CORRELATION OF NEUTRON PRODUCTION TO X-RAYS AND VISIBLE LIGHT IN A DENSE PLASMA FOCUS M.S. Thesis
Craig M. Lee Mar. 1971 84 p refs
(AD-729780; GEP/PH/71-12) Avail: NTIS CSCL 20/9

Characteristics of neutron production from a 16-27 kJ plasma focus device were systematically studied for device parameters of bank energy, gas pressure, gas impurities and anode geometry. Neutron yields of 10 to the 9th power - to -10 to the 10th power per discharge were obtained with deuterium. Comparison of neutron and hard X-ray production was made using photomultiplier-plastic scintillator detectors. The axial neutron distribution was determined using a paraffin-polyethelene collimator. A good time correlation between the hard x-rays and the neutrons was observed. The dependence of the axial neutron source distribution on pressure was obtained and related to the shape of the collapsing plasma boundary. Author (GRA)

N72-14755# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A TIME-RESOLVED ROSS FILTER SYSTEM FOR MEASURING X-RAY SPECTRA IN Z-PINCH PLASMA FOCUS DEVICES Technical Operating Report, Jul. 1967 - Jan. 1970
Hugo L. L. VanPaassen 15 Sep. 1971 21 p refs
(Contract F04701-71-C-0172)
(AD-729809; TR-0172(2220-60)-1; SAMSO-TR-71-192) Avail:

NTIS CSCL 20/9

The development of plasma pinch and other flash x-ray devices has created the need for a system capable of measuring the spectra of 50-nsec x-ray pulses. A Ross filter system used in conjunction with silicon diode x-ray detectors gives nanosecond time resolution in spectral intervals between 5.46 and 115.6 keV. Author (GRA)

N72-14756# Florida Univ., Gainesville. Dept. of Aerospace Engineering.

AN EXPERIMENTAL STUDY OF ELECTRODELESS ARC DISCHARGES Final Report, Nov. 1969 - Jan. 1971

Dennis R. Keefer Arnold Air Force Station, Tenn. AEDC Sep. 1971 62 p refs

(Contract F40600-70-C-0003; AF Proj. 8952)

(AD-729782; AEDC-TR-71-180) Avail: NTIS CSCL 20/9

An experimental study of electrodeless discharges, stabilized in a flowing stream, has shown that a substantial improvement in stability can be accomplished by the use of a bluff body placed in the entering flow. The increased stability is attributed to energy convection by the circulation cell formed in the wake of the bluff body. Spectroscopic measurements indicate that a more uniform temperature profile is produced as a result of the convective mixing. Detailed measurements indicate that a stable discharge can be maintained with flow rates 3 times greater than is possible with vortex stabilization. It was further determined that the gas heating efficiency of the device is increased by an order of magnitude when compared to the vortex stabilized discharge. The efficiency was found to increase with both power input and flow rate with no indication of a leveling off up to the maximum of 18% measured in the course of the study. A large discharge chamber was constructed to permit operation at pressures to ten atmospheres and input powers to 400 KW, but only preliminary experiments were performed. Author (GRA)

N72-14757# ARO, Inc., Arnold Air Force Station, Tenn.

TWO DIMENSIONAL FLOW CALCULATIONS IN THE ELECTRIC FIELD PLANE FOR LINEAR MHD CHANNELS Final Report, 5 Jul. 1966 - 30 Jun. 1970

Paul W. Johnson AEDC Sep. 1971 63 p refs

(Contract F40600-72-C-0003; AF Proj. 8950; ARO-PW5704)

(AD-730289; AEDC-TR-71-181; ARO-PWT-TR-71-118; Program-Element-62405334) Avail: NTIS CSCL 20/9

The two-dimensional, steady, compressible, inviscid flow of ionized gas through linear, segmented electrode, magnetohydrodynamic (MHD) channels is computed in the plane of the applied electric field. The solutions obtained for the gas dynamic and electrical quantities satisfy the coupled fluid mechanical conservation laws and Maxwell's equations at all points of the flow field simultaneously. The nonuniform profiles which are obtained include the effects of transverse variations in incoming gas dynamic profiles, local Hall currents in Faraday channels, transverse currents in Hall devices, and axial magnetic field gradients. Author (GRA)

N72-14758# Tel-Aviv Univ. (Israel). Dept. of Applied Mathematics.

DISCONTINUOUS MAGNETOFLUIDYNAMIC FLOWS. NONLINEAR LIQUID SIMULATIONS, FORMATION OF SHOCKS Final Scientific Report

Nima Geffen Jun. 1970 42 p refs

(Contract F61052-68-C-0045; AF Proj. 9752)

(AD-729943; AFOSR-71-2336TR) Avail: NTIS CSCL 20/9

The radial motion of a free-surface liquid conductor, in a cylindrical container, induced by a time-varying, spacially homogeneous transverse magnetic field is described. This situation is somewhat analogous to a plasma pinch. The hydraulic (or shallow liquid) approximation is used, where forcing and friction terms are added by the electromagnetic interaction, to the quasi-linear hyperbolic differential operator occuring in the non-magnetic case. The equations are analysed, then integrated by two independent methods: a rectangular finite differences mesh, and a characteristics mesh. The results are compared for efficiency and information yielded. In addition, a similarity solution is found for the initial characteristic triangle and the breakdown of the continuous solution, and the formation of jump (or shock) is estimated a-priori semi-analytically. Results for one set of the physical variables are presented. Author (GRA)

N72-14759# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.

UNSTEADY PLASMA BOUNDARY LAYER FLOW OVER AN INFINITE FLAT PLATE IN THE PRESENCE OF AN APPLIED MAGNETIC FIELD

T. S. Chang (North Carolina State Univ.) and C. M. Chang (North Carolina State Univ.) Jun. 1971 121 p refs

(Contract DAAD05-69-C-0053; THEMIS Proj. 65)

(AD-729959; CAM-110-13; BRL-CR-43) Avail: NTIS CSCL 20/9

The initial motion of the unsteady plasma boundary layer flow over an infinite flat plate with heat transfer effects under the influence of an applied magnetic field is studied. Based on a plasma kinetic formulation, small-time solutions are derived for the linearized Rayleigh's problem in plasmas consisting of collisionless electrons embedded in immobile ions. Detailed discussions are presented concerning the time-dependent distributions of a number of interesting plasma flow properties. The present method of solution, believed to be the first of such attempts, seems to be applicable to a large class of plasma boundary layer flow problems in which the interactions between moving plasmas and solid surfaces are important. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-14760# Eidgenossische Technische Hochschule, Zurich (Switzerland).

THE ISOTOPIC EFFECT OF CADMIUM, MOLYBDENUM, AND ZIRCONIUM SUPERCONDUCTORS, 1. ON THE EFFECT OF PRESSURE ON SEVERAL SUPERCONDUCTING ELEMENTS, 2 Ph.D. Thesis

Caludio Palmy 1970 70 p refs In GERMAN; ENGLISH summary

(Diss-4546) Avail: NTIS

Investigations on the isotope effect of the superconductors Zr, Mo and Cd are reported. The experimental results show a vanishing isotope effect in Zr and an intermediate one in Cd and Mo. These deviations from the normal isotope effect are well understood within the framework of the theory of Bardeen, Copper and Schrieffer if the Coulomb repulsion is included in the effective interaction. Author

N72-14761# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.

THE IN SITU FORMATION OF GERMANIUM THIN FILMS

H. Kivlighn Dec. 1971 21 p refs

(RM-526) Avail: NTIS

A novel method was discovered for forming thin films of germanium on oxygen-deficient glasses prepared from germanium dioxide. It appears that the potential exists for developing films with amorphous or crystalline character. The best results are obtained when the surface of the original glass is ground and polished before treatment in a hydrogen environment. An effort is made to assess the thin film formation in terms of chemical bond variations that are postulated to exist in oxygen-deficient germanium-oxygen glasses. Author

N72-14762*# Translation Consultants, Ltd., Arlington, Va.
EXPERIMENTAL STUDY OF THE HEDENBERGITE PLUS WOLLASTONITE EQUALS ANDRADITE PLUS QUARTZ REACTION
L. D. Kurshakova Washington NASA Jan. 1972 24 p refs Transl. into ENGLISH of "Eksperimentalnoye Izucheniye Reaktsii Gedenbergit Plyus Vollastonit Davayet Andradit Plyus Kuarts" from Ocherki Fiz-Khim. Petrologii, v. 2, 1970 p 99-115
(Contract NASw-2038)
(NASA-TT-F-14014) Avail: NTIS CSCL 20B

Experimental investigations of the phase equilibrium during hedenbergite + wollastonite = andradite + quartz reactions are described. The investigations were conducted using sealed ampule experiments at different temperatures and partial oxygen pressures. Constancy of the partial oxygen pressure was maintained by using redox buffer systems. Reaction equilibrium was investigated by processing samples of hedenbergite + wollastonite or andradite + quartz composition and establishing the equilibrium during hydrothermal treatment. Samples compounded from chemicals, rather than minerals, with the appropriate compositions were subjected to the same experimental investigations as were the mineral samples. The free energies of beta quartz, wollastonite, andradite, hedenbergite and magnetite were calculated at 500, 700, 900 and 1100 K. On the basis of this investigation a composite phase diagram relating log f O2 and T in the 300 to 1000 C range for CaO-Fe2O3-SiO2+H2O systems was constructed. Author

N72-14763# Battelle-Northwest, Richland, Wash.
EFFECT OF TEMPERATURE ON VOID FORMATION IN IRRADIATED PURE AND IMPURE METALS
J. L. Brimhall, H. E. Kissinger, and G. L. Kulcinski 1971 43 p refs Presented at the Intern. Conf. on Radiation Induced Voids in Metals, Albany, 9 Jun. 1971 Sponsored by AEC
(BNWL-SA-3921; conf-710601-7) Avail: NTIS

Results are given and discussed for studies of void formation in a number of irradiated high purity metals. Particular emphasis is devoted to the temperature dependence of swelling in molybdenum, nickel and rhenium. In general, voids occur in the temperature region approximately 0.3 T sub m to 0.55 T sub m where T sub m is absolute melting temperature. This temperature regime is essentially determined by the relative stability of vacancy configurations at the low temperature end and the vacancy supersaturation at the high temperature end. The results are further discussed in terms of current theories of void formation. The effect of small variations in impurity level in molybdenum and nickel on void formation was also studied. Large differences in the size and number density of voids occur in material of the same overall purity level but with relatively small variations in type and amount of impurity. However, the void swelling appears to depend only on the magnitude of the overall purity level. These results are compared to similar results of other investigators on other materials. Author (NSA)

N72-14764# Air Force Systems Command, Wright-Patterson AFB, Ohio.
PHYSICAL PROPERTIES OF SEMICONDUCTORS A(III)B(V) AND A(III)B(VI): SELECTED ARTICLES
M. B. Kagan, M. M. Koltun, A. P. Landsman, Ya. Agaev, and A. R. Mikhailov 8 Jul. 1971 26 p refs Transl. into ENGLISH from Vses. Konf. Fizicheskim Svoistvam Poluprov. A(III)B(V) i A(III)B(VI), Oct. 1965. Materialy, Fiz. Svoistva Poluprov. A(III)B(V) i A(III)B(VI), Baku, Izd. vo AN Azer. SSR, 1967 p 171-176, 312-318
(AF Proj. 604010)
(AD-729080; FTD-MT-24-34-71; DIA-Task-T69-04-9) Avail: NTIS CSCL 20/12

Contents: Optical properties of heavily doped gallium arsenide within a wide spectrum interval; Certain electrical and thermal properties of AlSb crystals. GRA

N72-14765# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTERBAND MAGNETOREFLECTION OF Hg(1x)Cd(x)Te
Steven H. Groves, Theodore C. Harman, and Carl R. Pidgeon 3 Dec. 1970 7 p refs Repr. from Solid State Commun., v. 9, no. 8, 1971 p 451-455 Prepared in cooperation with MIT, Cambridge
(Contract AF 19(628)-5167)
(AD-729574; JA-3800; ESD-TR-71-217) Avail: NTIS CSCL 20/12

Interband magnetoreflection experiments on Hg(0.84)Cd-(0.16)Te give a valence band effective mass of 0.3 m sub zero appropriate to the (100) plane. The (Gamma sub 6) - (Gamma sub 8) separation is slightly negative at 4K degrees and slightly positive at 77 degrees. About twenty magneto-optical transitions are seen and indicate a high level of homogeneity for this material. Author (GRA)

N72-14766# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
INFRARED PHOTOCONDUCTIVITY OF ELECTRON-IRRADIATED PHOSPHORUS DOPED SILICON Final Report, 15 Sep. 1969 - 30 Apr. 1971
Rosa C. Young and John C. Corelli 1 Aug. 1971 81 p refs
(Contract F19628-70-C-0042; AF Proj. 5621-09-01)
(AD-729477; AFCRL-71-0383; Rept-1) Avail: NTIS CSCL 20/12

The annealing behavior and the uniaxial stress responses of the radiation-induced defect causing the (E sub C) - 0.75 eV, (E sub C) - 0.42 eV and (E sub C) - 0.18 eV photoconductivity energy levels in n-type silicon were studied after 1.5 MeV electron and 60Co gamma ray irradiation. The results suggest that the (E sub C) - 0.75 eV level arises from the electronic transition of the neutral charge state of the divacancy to the conduction band, the (E sub C) - 0.18 eV level arises from the A-center defect which exhibits only one kind of stress response, i.e. the atomic redistribution among the allowable orientations. No electronic response can be observed for the A-center in the case of photoconductivity measurements. The data fit very well with the A-center model given by G. D. Watkins and J. W. Corbett. Author (GRA)

N72-14767# Office of Naval Research, London (England).
CONDUCTION IN LOW MOBILITY MATERIALS: REPORT ON AN INTERNATIONAL CONFERENCE HELD IN EILAT, ISRAEL, 5-9 APRIL 1971
Immanuel Estermann 26 Jul. 1971 17 p refs
(AD-729636; ONRL-C-16-71) Avail: NTIS CSCL 20/12

The report covers an international conference devoted to conduction in low-mobility materials, such as amorphous semiconductors, glasses, organic crystals and polymers, selenium and selenium compounds, and oxides of transition metals. Measurement techniques described include dc and high-frequency electrical conductivity, Hall effect, thermoelectric power, and optical absorption. Theoretical models for the electrical and optical processes occurring in these materials are developed and discussed. Author (GRA)

N72-14768# National Bureau of Standards, Washington, D.C.
ARPA-NBS PROGRAM OF RESEARCH ON HIGH TEMPERATURE MATERIALS, 1 JANUARY - 30 JUNE 1971
Alan D. Franklin and H. S. Bennett 30 Jun. 1971 41 p refs
(ARPA Order 373; NBS Proj. 2000400; ARPA Proj. 1D10)
(AD-730089; NBS-10605) Avail: NTIS CSCL 11/2

Progress reports are given for projects on the growth of ultra-pure Al2O3 crystals, the development of a mass spectrometer-based sectioning technique for measuring oxygen diffusion in oxides and the development of a precision facility for measuring the threshold energy in a laser beam producing damage in a transparent substance. Author (GRA)

N72-14769# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
BOUNDARY EFFECTS, AND ATOMISTIC ASPECTS OF BOUNDARY SLIDING AND DIFFUSIONAL CREEP

M. F. Ashby Aug. 1971 67 p refs
(Contract N00014-67-A-0298-0020; NR Proj. 031-732)
(AD-730094; TR-5) Avail: NTIS CSCL 20/2

The paper describes behavior of atoms in a grain or phase boundary when the boundary slides (when the crystals which meet at the boundary suffer a relative shear displacement parallel to the boundary plane) and during diffusional creep (when the crystals which meet at the boundary suffer both a normal and a shear translation). Boundary defects are involved. They are dislocations, with Burgers' vectors which need not be lattice vectors of either crystal. If they are sufficiently numerous and mobile, the rate of sliding and diffusional creep is given by the classical, continuum models. But if their density is low, or their motion is hindered, the rate of sliding and of creep is less than that predicted by the classical treatments. Equations for sliding and creep rates are developed. Author (GRA)

N72-14770# Wyoming Univ., Laramie. Dept. of Physics.
ELECTRONIC STATES AND TRANSPORT IN HIGHLY DOPED SEMICONDUCTORS Summary Progress Report, 1 Dec. 1970 - 31 Aug. 1971
Shinzo Nakai, Waldemar F. Klawiter, and Mohit Bhattacharyya 1 Sep. 1971 11 p refs
(Contract N00014-67-A-0266-0001; NR Proj. 017-650)
(AD-730091; Rept-06b891) Avail: NTIS CSCL 20/12

The resistivity and the Hall coefficient in doped semiconductors are calculated using the Green function method for high impurity concentration at temperatures near zero. The results are compared with the experimental results. Through this comparison, the effects of localized states in the impurity band to the resistivity and the Hall coefficient are investigated.
Author (GRA)

N72-14771# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID STATE DEVICE AND CIRCUIT STUDIES Technical Report, 1 Dec. 1970 - 1 Mar. 1971
G. I. Haddad Jun. 1971 89 p refs
(Contract F30602-71-C-0099)
(AD-729711; Rept-037250-2; RADC-TR-71-109) Avail: NTIS CSCL 09/5

The objectives are to investigate theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification, and control. Current tasks under the program are: High-power Gunn-effect devices; Gunn-effect amplifiers; Modulation properties of Gun-effect devices; Avalanche-diode amplifiers; High-efficiency avalanche diodes; Nonlinear operating characteristics of IMPATT diodes; Solid-state device fabrication; Instabilities in germanium.
Author (GRA)

N72-14772# Research Advisory Inst., Newport Beach, Calif.
DEVICE APPLICATIONS OF CRYOGENICS. PART 1: SUPERCONDUCTING ELECTRONICS Final Report on Phase 1
John Clarke, George J. Dick, Donald N. Langenberg, William A. Little, James E. Mercereau, Paul L. Richards, and Douglas J. Scalapino Jul. 1971 334 p refs
(Contract N00014-70-C-0133; RF Proj. 018-02-06; NR Proj. 274110)
(AD-729697; Rept-100) Avail: NTIS HC $6.00/MF $0.95 CSCL 09/3

The purpose of this study is to present a brief review of the physics of the low temperature phenomenon, superconductivity; to describe the characteristics, technology, and capabilities of electronic devices based on the unusual properties of superconductors; and to indicate some of the ways in which these devices may be applied to the solution of important technological problems. The report also contains a review of the present state of the art of small refrigeration systems applicable to superconducting electronic systems, and discusses the prospects for development of superconducting materials with higher transition temperatures and critical fields. Specific recommendations are made for areas of possible Navy applications of this new electronic technology as well as areas in which further research and development seem appropriate in order to determine Navy use. Author (GRA)

N72-14773# North Carolina Univ., Chapel Hill.
ELECTRONIC STATES IN DISORDERED MATERIALS Semiannual Technical Report, 1 Jan. - 31 Jul. 1971
M. Silver and K. S. Dy 31 Jul. 1971 32 p refs
(Grant DA-ARO(D)-31-124-71-G52; ARPA Order 1562)
(AD-730377) Avail: NTIS CSCL 20/12

Three problems were investigated and these were: (1) Monte Carlo calculations of transient photocurrents; (2) Electron drift in very dense helium; and (3) Electronic structure of a one dimensional disordered array of delta-function potential.
Author (GRA)

N72-14774# Energy Conversion Devices, Inc., Troy, Mich.
RESEARCH ON THE PROPERTIES OF AMORPHOUS SEMICONDUCTORS AT HIGH TEMPERATURES Semiannual Technical Report, 18 Nov. 1970 - 18 May 1971
John P. DeNeufville 18 Jul. 1971 191 p refs
(Contract DAHC15-70-C-0187; ARPA Order 1570)
(AD-730449; ECD-516-2; SATR-2) Avail: NTIS CSCL 20/12

The report describes the work performed during the second six-month period of Contract DAHC15-70-C-0187. Emphasis on the compositional dependence of electrical and optical gaps and glass transition temperatures has been retained. In addition, detailed studies of thermoelectric power, switching behavior, thermal stability of thin films, crystallization kinetics, and electromigration have been initiated and extensive results of these studies are presented herein. These measurements have been obtained primarily on thin film samples produced by R. F. sputtering using an Argon plasma. The effects of thermal history in determining the physical properties of these thin amorphous films at 25 C and as a function of temperature have been studied extensively. In addition the liquid heat capacity results report previously for liquid Ge17Te83 have been extended to include six other tellurium rich alloys including pure tellurium. Three contributed papers and one invited paper describing work performed under this contract were presented at the Fourth International Conference on Amorphous and Liquid Semiconductors in Ann Arbor, Michigan on August 9-13, 1971.
Author (GRA)

N72-14775# School of Aerospace Medicine, Brooks AFB, Tex.
NUCLEAR GAMMA-ACOUSTIC RESONANCE
V. G. Pokazanev 1971 13 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (USSR), v. 29, 1970 p 496-501
(AD-730190; SAM-TT-R-1103-0971) Avail: NTIS CSCL 20/12

The paper studies the effect of nuclear acoustic resonance on the nature of resonance absorption and emission of gamma quanta. It is shown that the absorption intensity and gamma radiation depend on the frequency of ultrasound and on the degree of polarization of the nuclei. An estimate of signal resonance is given for Fe57 nuclei. If the frequency of ultrasound is equal to the Larmor frequency of nuclei in an excited state, the acoustic resonance of the nuclei is detected on the basis of additional lines in gamma radiation. Analogous results are expected also in the case when spin transitions are induced by a radiofrequency field. Author (GRA)

N72-14776# Texas Univ., Austin.
AMORPHOUS SEMICONDUCTORS Semiannual Technical Report, 1 Apr. - 30 Sep. 1971
James C. Thompson 30 Sep. 1971 11 p refs
(Grant DA-ARO(D)-31-124-71-G102; ARPA Order 1562)
(AD-730940; ARPA-Code-0D10) Avail: NTIS CSCL 20/12

The study of glasses under pressure has been extremely rewarding insofar as the conventional (oxide) glasses are concerned. The study of semiconducting glasses has only begun. The project is concerned with the correlation of electrical

properties with the thermodynamic state of the system. It hopes to identify the electrical conduction mechanism and to determine the equation of state. The former will permit the better utilization of these materials in electronic devices and the latter will enable the potential military user to better assess the behavior under extreme conditions. Author (GRA)

N72-14777# Army Materials and Mechanics Research Center, Watertown, Mass.

AN INTENSITY MODIFIED STEROGRAPHIC PROJECTION OF ALPHA-Al2O3

Charles P. Gazzara and Jaroslav Caslavsky Aug. 1971 20 p refs

(DA Proj. 1T0-61102-B-11-A)

(AD-730320; AMMRC-TR-71-26) Avail: NTIS CSCL 20/2

Standard stereographic projections of the (001) and the (hh0) for alpha-Al2O3 (corundum) are presented, indicating the approximate X-ray diffraction intensities at each pole shown in the projection. A table of interplanar angles is listed along with Laue back reflection photographs of six commonly used crystal orientations. Author (GRA)

N72-14778# Florida Univ., Gainesville. Dept. of Electrical Engineering.

A CENTER OF COMPETENCE IN SOLID STATE MATERIALS AND DEVICES

Stephen W. Lindholm, Arthur J. Brodersen, Eugene R. Chenette, Stephen W. Director, and Larry L. Hench 10 Mar. 1971 232 p refs

(Contract F19628-68-C-0058; ARPA order 1060; AF Proj. 8687)

(AD-729908; AFCRL-71-0309; SR-7; DoD-Element-61101D) Avail: NTIS CSCL 20/12

In semiconductor and semiconductor device research, a complete equivalent circuit for the noise performance of phototransistors is developed and the current gain and cutoff frequency are derived from noise measurements. Study of the design of a detector. Using the PME effect in gold-doped silicon shows the compromises required in the concentrations of gold and shallow-level impurities to yield both speed and sensitivity. Measurement of conductivity and Hall effect in In-doped and Cu-doped CdS reveals the impurity levels and dominant scattering mechanisms. Measurement of the PME and PC effects in gold-doped silicon yields the recombination parameters. A method is described that so selects model complexity in the simulation of transistor circuits as to save cpu time and to accommodate larger circuits than heretofore possible. In glass and semiconducting glass research, experiments demonstrate that crystallite size determines the threshold of fast-neutron damage in heterogeneous amorphous semiconductors. Various methods for surface characterization of ceramic powders are detailed. A computer program is described that calculates and plots pertinent behavior of electronic ceramic materials based on humidity-dependent dielectric data. Author (GRA)

N72-14779# Technische Hochschule Stuttgart (West Germany). Inst. for Mechanics.

THEORETICAL INVESTIGATIONS OF THE BEHAVIOR OF BRITTLE MATERIALS AT VARIOUS RANGES OF TEMPERATURE Technical Report, Feb. 1967 - Mar. 1969

E. H. Udo Wegner Wright-Patterson AFB, Ohio AFML Apr. 1971 40 p refs

(Contract F61052-67-C-0064 AF Proj. 7350)

(AD-730352; AFML-TR-71-67; Task-735003) Avail: NTIS CSCL 20/12

A general non-linear law of material behavior was developed with the assumptions that the energy density of an isotropic material is invariant under the orthogonal group of transformations and that hydrostatic pressure produces only a volume change. For materials with crystal lattices, the energy density is assumed to be invariant under the crystalline group. This general law allows for the effects of thermal processes. Equations which are generalizations of the Beltrami equations and of the equation of heat conduction are stated to permit the determination of the unknown displacements and the temperature. These laws are very important in the use of brittle materials. As a part of the research, a non-linear thermodynamic theory for materials is established. Author (GRA)

N72-14780# Army Missile Command, Redstone Arsenal, Ala.

PHOTOCONDUCTIVITY AND SURFACE DEGRADATION OF DEGENERATE N-TYPE GaAs RESULTING FROM LASER EMISSION

J. Lynn Smith May 1971 46 p refs

(DA Proj. 1T0-61102-B-23-A)

(AD-730663; RR-TR-71-3; AMC-501B.11.02800) Avail: NTIS CSCL 20/12

An experimental and theoretical study of photoconductivity and surface damage of n-type GaAs resulting from pulsed ruby laser emission is presented in this report. Experiment and theory indicate that sublinearity of the photoconductivity is caused by electron-hole recombination, the rate of which increases approximately with excitation as the product of electron and hole densities. Surface damage is concurrent with degradation of the phoroconductivity response. Electron microprobe analysis indicates that during intense optical excitation, Ga rich material develops on the surface with As escaping into the air. Details of the experimental arrangement for photoconductivity measurements are given, and surface damage is shown via photomicrographs. Author (GRA)

N72-14781# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ADSORPTION OF LIGHT BY TWO-ZONE SUPERCONDUCTORS

N. I. Botoshan and V. A. Moskalenko 5 Aug. 1971 26 p refs Transl. into ENGLISH from Teor. Mat. Fiz. (USSR), v. 2, no. 3, 1970 p 383-398

(AF Proj. 3145)

(AD-730369; FTD-MT-24-52-71) Avail: NTIS CSCL 20/12

The behavior of a two zone superconductor with paramagnetic admixture in a changing magnetic field is investigated. The adsorption coefficient of light by a two zone superconductor with nonmagnetic admixture is obtained in the case of zero temperature and high admixture concentration. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-14782*# Southwest Research Inst., San Antonio, Tex.

AN EXPERIMENTAL STUDY OF AXISYMMETRIC MODES IN VARIOUS PROPELLANT TANKS CONTAINING LIQUID Final Report

Daniel D. Kana and Andrew Nagy May 1971 63 p refs

(Contract NAS8-30167; SwRI Proj. 02-2583)

(NASA-CR-118900; DCN-1-9-53-20030; DCN-1-9-53-20030) Avail: NTIS CSCL 13D

An experimental study of several models used to analyze the longitudinal dynamics of oscillations in launch vehicle propellant tanks, is presented. Several vehicle structural configurations are considered: hemispherical and spherical, cylindrical and spherical, and semiellipsoidal and ellipsoidal. Various bulkheads and flanges are used with each configuration. The results are given in graphs. E.H.W.

N72-14783*# Southwest Research Inst., San Antonio, Tex.

FURTHER STUDIES OF PROPELLANT SLOSHING UNDER LOW-GRAVITY CONDITIONS Final Report

Franklin T. Dodge Mar. 1971 23 p refs
(Contract NAS8-24022; SwRI Proj. 02-2578)
(NASA-CR-119892; DCN-1-9-75-10061(3F)) Avail: NTIS CSCL 21I

A variational integral is formulated from Hamilton's Principle and is proved to be equivalent to the usual differential equations of low-gravity sloshing in ellipsoidal tanks. It is shown that for a zero-degree contact angle the contact line boundary condition corresponds to the stuck condition, a result that is due to the linearization of the equations and the ambiguity in the definition of the wave height at the wall. The variational integral is solved by a Rayleigh-Ritz technique. Results for slosh frequency when the free surface is not bent-over compare well with previous numerical solutions. When the free surface is bent over, however, the results for siosh frequency are considerably larger than those predicted by previous finite-difference, numerical approaches: the difference may be caused by the use of a zero degree contact angle in the present theory in contrast to the nonzero contact angle used in the numerical approaches. Author

N72-14784# Dynamic Science, Phoenix, Ariz. AvSER Facility.
SAFETY EVALUATION OF EMULSIFIED FUELS Final Report
L. Maurice Shaw Fort Eustis, Va. AAMRDL Jun. 1971 193 p refs
(Contract DAAJ02-69-C-0030; DA Proj. 1F1-62203-A-529)
(AD-729330; AvSER-9130-71-3; USAAMRDL-TR-71-29) Avail: NTIS CSCL 21/4

A comprehensive test program was conducted to establish emulsified fuel screening test procedures, to obtain safety evaluation criteria, and to evaluate the safety performance of emulsified and gelled aviation fuels in a simulated full-scale crash environment. A series of screening tests was formulated and conducted to obtain fuel characteristics as a function of hot-surface ignition, wind shear, and impact dynamics associated with fuel breakup, atomization/dispersion, and ignition. The data obtained from these screening tests were used to establish emulsified fuel safety evaluation criteria. A simulated full-scale experiment was designed to simulate the full-scale helicopter crash environment adequately and, in addition, to be reproducibly controllable at minimal cost. The screening tests revealed that, for the emulsified fuels tested, safety was directly dependent upon the fuel yield stress and its internal phase base fuel. The data obtained from the simulated full-scale tests provided definition of a nonhazardous limiting value for the ignition susceptibility parameter. Further, tests were performed on gelled fuels to offer a comparison between the safety of emulsified and gelled fuels. Three of the emulsified fuels tested were found to result in a nonhazardous postcrash fire: EF8R-104H emulsion, EF8R-104 emulsion, and Jet-A EXP-4 emulsion. The gelled fuels did not perform as well as the emulsified fuels; however, one gel, Jet-A gel no. 1, indicated a sizeable advantage over liquid fuels. In summary, the results of this program confirmed that aircraft fuel emulsions can be formulated which are nonhazardous within the helicopter survivable crash limit envelope.
Author (GRA)

N72-14785# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AVIATION TURBINE FUEL Final Report
1 Aug. 1971 144 p refs
(AMCR Proj. 310-6)
(AD-729544; MTP-10-3-061) Avail: NTIS CSCL 21/4

Procedures are given for service testing aviation turbine fuel.
Author (GRA)

N72-14786# Air Force Systems Command, Edwards AFB, Calif.
HEXACYANOFERRIC (II) ACID AND COPPER (II) HEXACYANOFERRATE (II): EFFICIENT, ENERGETIC, POTENTIALLY LOW COST BURN RATE ADDITIVES Final Report, Jan. - Jul. 1971
Francis M. VanMeter Aug. 1971 17 p refs
(AF Proj. 314801ACL)
(AD-729885; AFRPL-TR-71-91) Avail: NTIS CSCL 21/9

Preparation and some preliminary evaluation has been made of two potential new burn rate additives, hexacyanoferric (II) acid ($H_2Fe(CN)_6$) and copper (II) hexacyanoferrate (II) ($Cu_2Fe(CN)_6$). These compounds show promise of high efficiencies as additives to increase propellant burn rates. They are, in addition, potentially very inexpensive to produce and are sufficiently energetic that they would not degrade the specific impulse of propellants as much as the burn rate additives in current use. They also may not show the plasticizer migration and post-cure problems associated with ferrocene burn rate additives.
Author (GRA)

N72-14787# Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
FUNDAMENTAL PROCESSES IN SOLID PROPELLANT IGNITION Final Scientific Report, 1 Feb. 1967 - 31 Jul. 1971
R. Krishna Kumar and Clarke E. Hermance Jul. 1971 99 p refs
(Grant AF-AFOSR-1274-67; AF Proj. 9711-01)
(AD-730384; AFOSR-71-1968TR; Rept-61102F; Rept-681308) Avail: NTIS CSCL 21/9

Analytically and numerically determined behaviour of the diffusion equations, with chemical reactions, describing a gas phase ignition process for homogeneous and composite solid propellants, suddenly exposed to an ignition stimulus, are reported. Stimuli considered are a high pressure and temperature, stagnant gas of specified oxidizer content, or a radiant heat flux impinging on a non-opaque propellant exposed to a low temperature gas phase of specified pressure and composition. The results, assuming a radiant stimulus, indicate that purely gas phase reaction processes play only a minor role in the overall ignition behaviour. Qualitative agreement with experiments is found for several flux and pressure levels. Most interesting are the results using a hot gas stimulus. In homogeneous propellants, ignition involves consecutive development of a primary flame between propellant pyrolysis products, and a secondary flame using unburned fuel from the primary flame and any ambient oxidizer present. A unique calculation of light emission during ignition development allowed direct theoretical/experimental comparison of results. Composite propellants ignite via pyrolysis of the propellant and reaction of fuel species with any ambient oxidizer present, followed by reaction with propellant produced oxidizer species. Matching of gas phase ignition processes produce ignition behaviour in excellent, quantitative agreement with experiments using a hot gas stimulus, regarding effects of ambient gas phase pressure and composition on the ignition delay.
Author (GRA)

N72-14788# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
A TWO-DIMENSIONAL PHOTOELASTIC TECHNIQUE FOR EVALUATING THE STATE OF STRESS IN SOLID PROPELLANT ROCKET MOTORS
Judson R. Griffin Jun. 1971 22 p refs
(DA Proj. 1A6-2500-D-12)
(AD-730665; RL-TR-71-6) Avail: NTIS CSCL 21/9

The purpose of this report is to present the results of an investigation performed to demonstrate by experimental methods a stress analysis for a propellant grain. The experimental analysis was made using a two-dimensional plastic model. The two-dimensional photoelastic method of experimental stress analysis, as described in this report, can be used to design and optimize various structural components in the laboratory thereby greatly reducing the amount of full scale testing necessary to produce the optimized prototype hardware.
Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-14789 Stevens Inst. of Tech., Hoboken, N.J.
VIBRATION CHARACTERISTICS AND DEFORMATION DUE TO CENTRIFUGAL LOADING OF LOW ASPECT RATIO COMPRESSOR BLADES Ph.D. Thesis
Ralph Donald Petricone 1970 144 p
Avail: Univ. Microfilms Order No. 71-1182

Distortion in the chordwise elements of compressor blades was considered. It was assumed that the geometry of a typical blade can be represented by a right helicoid, in order to qualitatively study its mechanical behavior. The Rayleigh-Ritz minimum energy procedure was used as a means of computing the natural frequencies, mode shapes, and deformations due to centrifugal loading. Natural frequencies and mode shapes were calculated for a range of aspect ratios, skewed root angles, and pretwist angles. Calculations were also made for a variable thickness blade and for a blade with curvature in the chordwise direction. Some computations of deformations of a constant thickness helicoidal blade in a cylindrical centrifugal force field are presented. Dissert. Abstr.

N72-14790*# Bell Aerospace Co., Buffalo, N.Y.
ADVANCED THRUST CHAMBER DESIGNS Final Report
F. J. Dietrich and A. E. Leach Jul. 1971 104 p
(Contract NAS3-7968)
(NASA-CR-72996; BAC-8489-945001) Avail: NTIS CSCL 21H

A regeneratively cooled thrust chamber has been designed and fabricated, consisting of an inner TD nickel liner which was spin formed, welded, and machined and an outer shell of electroformed nickel. Coolant channels were produced in the outer surface of the inner liner by the electric discharge machining process before electroforming the shell. Accessory manifolds and piping were attached by welding. Manufacturing processes employed are described. Author

N72-14791*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT INVESTIGATION OF AN UNDERWING NACELLE INSTALLATION OF THREE VARIABLE-FLAP EJECTOR NOZZLES
Verlon L. Head Washington Jan. 1972 47 p refs
(NASA-TM-X-2478; E-6564) Avail: NTIS CSCL 21E

A modified F-106B aircraft with underwing engine nacelles was flight tested to investigate airframe installation effects on ejector nozzles. Nozzle thrust coefficients, boattail drag coefficients, and boundary layer characteristics were obtained for the three nozzles. All the nozzles were geometrically similar and had 15 deg conical boattails with juncture radii of curvature equal to 0.5 maximum nozzle diameter. The effects of boattail location relative to the wing trailing edge and the ejector to primary nozzle exit diameter ratio were investigated. Shortening the length by 0.48 nozzle diameter lowered the transonic boattail drag rise Mach number from 0.97 to 0.95. Decreasing the nozzle exit diameter, which reduced the ejector to primary nozzle exit diameter ratio from 1.30 to 1.18, increased the gross thrust coefficient 4.8 percent. Author

N72-14792*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A TURBOJET SIMULATOR FOR MACH NUMBERS UP TO 2.0
Fred W. Steffen, Edward A. Satmary, Michael R. Vanco, and Stanley M. Nosek 1972 30 p refs Proposed for presentation at 16th Ann. Intern. Gas Turbine Conf. and Products Show, San Francisco, Calif., 23-30 Mar. 1972
(NASA-TM-X-67973; E-6690) Avail: NTIS CSCL 21E

A turbojet simulator was designed and fabricated for use in wind tunnel models. The simulator contains a six-stage, axial-flow compressor powered by a three-stage, axial-flow turbine. High pressure heated air was used to drive the turbine. At design conditions, compressor axial flow, turbine exit flow, and a third supplementary flow all entered the exhaust nozzle at equal values of pressure and termperature. Overall aerodynamic design, compressor operating conditions, automatic controls, turbine aerodynamic design, instrumentation, and calibration procedure is presented. Performance of the device when used to simulate a J-85 turbojet engine at transonic speeds is reported. The installed nozzle performance obtained with the simulator is also discussed and compared with flight data. Author

N72-14793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN STUDIES OF LIFT FAN ENGINES SUITABLE FOR USE IN CIVILIAN VTOL AIRCRAFT
Richard J. Roelke and Steve Zigan (GE, Cincinnati, Ohio) 1972 13 p refs Proposed for presentation at Gas Turbine and Fluid Eng. Meeting, San Francisco, Calif, 26-30 Mar. 1972
(NASA-TM-X-67977; E-6699) Avail: NTIS CSCL 21E

Low pressure ratio fan engines are receiving increasing attention as a means to provide low speed lift for civilian VTOL transports. Two general types of fan lift engines that are being studied are integral fans and remote power fans. Preliminary engine design studies of both types of lift fan systems have been made. The paper summarizes a portion of the results of the engine design studies, including the crucial engine requirements, and some of the characteristics of the emerging engine designs of each type. Author

N72-14794*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VARIABLE GEOMETRY AFT-FAN FOR TAKEOFF QUIETING OR THRUST AUGMENTATION OF A TURBOJET ENGINE
Richard J. Weber and David G. Evans Dec. 1971 22 p refs
(NASA-TM-X-67983 E-6714) Avail: NTIS CSCL 21E

A concept is presented that combines the low-noise and high-thrust characteristics of a turbofan at takeoff, together with its high efficiency at subsonic flight speeds, with the high efficiency of a turjojet at supersonic cruise. It consists of a free turbine with tip fan mounted behind the turbine of a conventional turbojet engine. Fan air is supplied from blow-in doors or is ducted from the main engine inlet. At high flight speeds where fan augmentation is not desirable, the fan inlet is closed and the free turbine is stopped by adjustment of its variable-camber stators. Estimates of noise, cycle performance, and example configurations are presented for a typical supersonic transport application. Author

N72-14795*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROGEN PLASMA TESTS OF SOME INSULATING COATING SYSTEMS FOR THE NUCLEAR ROCKET THRUST CHAMBER
Arthur N. Current, Salvatore J. Grisaffe, and Kurt C. Wycoff Washington Jan. 1972 55 p refs
(NASA-TM-X-2461; E-6565) Avail: NTIS CSCL 21F

Several plasma-sprayed and slurry-coated insulating coating systems were evaluated for structural stability in a low-pressure hot hydrogen environment at a maximum heat flux of 19.6 million watts/sq meter. The heat was provided by an electric-arc plasma generator. The coating systems consisted of a number of thin layers of metal oxides and/or metals. The materials included molybdenum, nichrome, tungsten, alumina, zirconia, and chromia. The study indicates potential usefulness in this environment for some coatings, and points up the need for improved coating application techniques. Author

N72-14796*# Aerophysics Research Corp., Bellevue, Wash.
OPTIMIZING A LIQUID PROPELLANT ROCKET ENGINE WITH AN AUTOMATED COMBUSTOR DESIGN CODE (AUTOCOM)
D. S. Hague, R. H. Reichel, R. T. Jones, and C. R. Glatt Dec. 1972 69 p refs
(Contract NAS3-13331)
(NASA-CR-120856) Avail: NTIS CSCL 21H

A procedure for automatically designing a liquid propellant rocket engine combustion chamber in an optimal fashion is outlined. The procedure is contained in a digital computer code, AUTOCOM. The code is applied to an existing engine, and design modifications are generated which provide a substantial potential payload improvement over the existing design. Computer time requirements for this payload improvement were small, approximately four minutes in the CDC 6600 computer. Author

N72-14797*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INITIATION SYSTEM FOR LOW THRUST MOTOR IGNITER
L. D. Strand, D. P. Davis, and J. I. Shafer 1 Jan. 1972 20 p refs
(Contract NAS7-100)
(NASA-CR-125067; JPL-TM-33-520) Avail: NTIS CSCL 21H

A test program was carried out to demonstrate an igniter motor initiation system utilizing the bimetallic material Pyrofuze for a solid propellant rocket with controlled low rate of thrust buildup. The program consisted of a series of vacuum ignition tests using a slab burning window motor that simulated the principal initial ballistic parameters of the full scale igniter motor. A Pyrofuze/pyrotechnic igniter system was demonstrated that uses a relatively low electrical current level for initiation and that eliminates the necessity of a pyrotechnic squib, with its accompanying accidental firing hazards and the typical basket of pyrotechnic pellets. The Pyrofuze ignition system does require an initial constraining of the igniter motor nozzle flow, and at the low initiating electrical current level the ignition delay time of this system was found to be quite sensitive to factors affecting local heat generation or loss rates. Author

N72-14798*# Colorado State Univ., Fort Collins.
DETERMINATION OF DECAY COEFFICIENTS FOR COMBUSTORS WITH ACOUSTIC ABSORBERS Technical Report, 1 Dec. 1970 - 30 Nov. 1971
C. E. Mitchell, W. R. Espander, and M. R. Baer Jan. 1972 80 p refs
(Grant NGR-06-002-095)
(NASA-CR-120836) Avail: NTIS CSCL 21H

An analytical technique for the calculation of linear decay coefficients in combustors with acoustic absorbers is presented. Tuned circumferential slot acoustic absorbers were designed for the first three transverse modes of oscillation, and decay coefficients for these absorbers were found as a function of backing distance for seven different chamber configurations. The effectiveness of the absorbers for off-design values of the combustion response and acoustic mode is also investigated. Results indicate that for tuned absorbers the decay coefficient increases approximately as the cube of the backing distance. For most off-design situations the absorber still provides a damping effect. However, if an absorber designed for some higher mode of oscillation is used to damp lower mode oscillations, a driving effect is frequently found. Author

N72-14799*# United Technology Center, Sunnyvale, Calif.
A STUDY OF PERFORMANCE AND COST IMPROVEMENT POTENTIAL OF THE 120 INCH (3.05 m) DIAMETER SOLID ROCKET MOTOR. VOLUME 1: SUMMARY REPORT Final Report
S. J. Backlund and J. N. Rossen Dec. 1971 34 p ref 2 Vol.
(Contract NAS2-6330)
(NASA-CR-114389; UTC-2401-FR-Vol-1) Avail: NTIS CSCL 21H

A parametric study of ballistic modifications to the 120 inch diameter solid propellant rocket engine which forms part of the Air Force Titan 3 system is presented. 576 separate designs were defined and 24 were selected for detailed analysis. Detailed design descriptions, ballistic performance, and mass property data were prepared for each design. It was determined that a relatively simple change in design parameters could provide a wide range of solid propellant rocket engine ballistic characteristics for future launch vehicle applications. Author

N72-14800*# United Technology Center, Sunnyvale, Calif.
A STUDY OF PERFORMANCE AND COST IMPROVEMENT POTENTIAL OF THE 120 INCH (3.05 m) DIAMETER SOLID ROCKET MOTOR. VOLUME 2: STUDY APPROACH AND DETAILED RESULTS Final Report
S. J. Backlund and J. N. Rossen Dec. 1971 260 p ref 2 Vol.
(Contract NAS2-6330)
(NASA-CR-114390; UTC-2401-FR-Vol-2) Avail: NTIS CSCL 21H

For abstract see N72-14799

N72-14801# Royal Aircraft Establishment, Farnborough (England).
DIRECT THRUST MEASUREMENTS OF THE ESKA 18P ION THRUSTER
H. J. Junge Sep. 1971 20 p refs Transl. into ENGLISH from the conf. paper Direkte Schubmessengen am Ionentriebwerk Eska 18P, paper no. 71-043 Presented at the DGLR Symp. on Elec. Propulsion Systems, Brunswick, 22-23 Jun. 1971
(RAE-LIB-TRANS-1600) Avail: NTIS

Thrust measurements on the ESKA 18P ion thruster were made using a force feedback thrust balance. The measured thrust was less than that calculated from electrical data, the difference decreasing with increasing exhaust velocity. This effect could not be ascribed to the presence of multiply charged ions in the beams, as it was not dependent on discharge voltage. In addition, measurements of beam divergence using a Langmuir probe were able to explain only a small proportion of the difference between the two values of thrust. It is postulated that losses of beam ions to the neutralizer may account for the remainder of the thrust reduction. Author

N72-14802# Garrett Corp., Torrance, Calif. AiResearch Mfg. Div.
INTEGRATED ENGINE INSTRUMENT SYSTEM: SELECTED STUDIES ON LOW-CYCLE FATIGUE Final Report
Robert R. VanNimvegen, Saurindranath Majumdar, and Joseph Kukel Sep. 1970 182 p refs
(Contract N00014-69-C-0343; NR Proj. 213-073)
(AD-728045; Rept-70-6785) Avail: NTIS CSCL 21/5

The objective of the analytical program was to define the engine operating parameters that affect the low-cycle fatigue and creep damage of critical components of naval aircraft engines during fleet operations. The following major program tasks were performed leading to the selection of a suitable model for predicting cumulative engine damage: A typical naval attack mission profile was selected for engine-aircraft operation. Control studies were made to determine engine response to transient operation at various ambient conditions. Transient and steady-state temperature distributions were determined for the critical engine components. Combined thermal and centrifugal stress, or pressure-induced stresses and plastic strains, were determined. Using existing material properties, low-cycle fatigue life was determined for the critical components. An analytical model was defined that simulated component thermal and stress response to selected engine parameters to be used in computing damage. Engine parameters were defined that can be monitored for calculating component low-cycle fatigue damage.
Author (GRA)

N72-14803# General Electric Co., Erie, Pa. Transportation Technology Center.
AC ELECTRIC WHEEL DESIGN STUDY
Jacob A. Chiera, L. Coffman, J. F. Haupt, and L. W. Ishler

26 Feb. 1971 242 p refs
(Contract DAAK02-70-C-0600)
(AD-729387; Rept-368-35) Avail: NTIS CSCL 21/3

The results of an ac electric wheel design study are presented. An evaluation of gear shift vs no gear shift, and the design of an integrated motor-gear-wheel assembly with potential use in construction equipment and trucks are included. In addition several tradeoff studies were conducted on motor types, motor design parameters, gearing, seals, and bearings. Four candidate configurations were developed including two gear shift, and two nongear shift versions. The design recommended and approved was a nongear shift version utilizing a high speed squirrel cage water cooled induction motor with three stage type gearing, and splash lubrication. Author

N72-14804# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
DESIGN OF MAXIMUM THRUST NOZZLES FOR GAS-PARTICLE FLOWS. VOLUME 1: THEORETICAL DEVELOPMENT AND RESULTS Technical Report, 15 Jul. 1969 - 31 May 1971
Arnold A. Elsbernd and Joe D. Hoffman Jun. 1971 103 p refs
(Contract f33615-67-C-1068)
(AD-729439; AFAPL-TR-71-52-Vol-1; Task-30120-9; BPSN-7(63-301206-6205214-1)) Avail: NTIS CSCL 21/5

An optimization analysis is presented for nozzles with gas-particle flows. The problem is formulated to maximize the axial thrust produced along the nozzle contour for a general isoperimetric constraint such as constant nozzle length or constant nozzle surface area. The effects of the ambient pressure are included in the thrust expression to be maximized. The characteristic and compatibility equations are developed and numerical techniques are presented for use in conjunction with the characteristic and compatibility equations. A solution procedure is presented which determines whether or not a given nozzle contour is an optimal solution and a relaxation technique is presented which adjusts the nozzle contour toward the optimal solution. Selected parametric studies are presented. These studies illustrate the effects of changing mesh size, particle size, particle mass flow rate, inlet angle, drag coefficients, heat transfer coefficients, throat radius of curvature, and the scale on the thrust performance and the nozzle geometry of the optimal, fixed length nozzle. Author (GRA)

N72-14805# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
DESIGN OF MAXIMUM THRUST NOZZLES FOR GAS-PARTICLE FLOWS. VOLUME 2: COMPUTER PROGRAM MANUAL Technical Report, 15 Jul. 1969 - 31 May 1971
Arnold A. Elsbernd and Joe D. Hoffman Jun. 1971 82 p refs
(Contract F33615-67-C-1068; AF Proj. 3012)
(AD-729440; AFAPL-TR-71-52-Vol-2; Task-30120-9; BPSN-7(63-301206-6205214-2)) Avail: NTIS CSCL 09/2

A program description, description of input parameters and four sample cases for the design program used to obtain maximum thrust nozzle contours for gas-particle flows are presented. The optimization analysis and the results of certain parametric studies were presented in Volume 1 of this report. Volume 2 contains a description of the program organization and overlay structure, a description of each subroutine, a description of the input parameters and their default values, and four sample cases to illustrate the use of the design program. Author (GRA)

N72-14806# Ohio State Univ. Research Foundation, Columbus.
SUPERSONIC COMBUSTION AND BURNING IN RAMJET COMBUSTORS Interim Report, 1 Apr. 1970 - 31 Mar. 1971
Rudolph Edse, Michael Neer, Eric Rice, and W. A. Strauss Jul. 1971 59 p refs
(Grant AF-AFOSR-1902-70; AF Proj. 9711-02; SR-1)
(AD-730955; AFOSR-71-2140TR) Avail: NTIS CSCL 21/5

At high initial pressures measured detonation wave speeds in hydrogen-oxygen mixtures are greater than those obtained from theoretical calculations while observed pressures of the detonated gas are less. Radiation from the combustion zone into the unburned gas appears to cause these deviations. Hydrogen-nitric oxide mixtures do not detonate at initial pressures below 10 atmospheres. A new shock tube employing a buffer gas section has been designed and constructed to investigate the cause of spontaneous ignitions in hydrogen-air mixtures at very low temperatures. Preliminary results indicate that at moderately high initial pressures low temperature spontaneous ignitions occur even in this facility. More experiments are needed to elucidate this behavior. Experiments with supersonic jets of hydrogen-chlorine mixtures showed that photochemical ignition with a mercury vapor lamp is possible. However, it appears that ignition occurs in the low speed boundary layer of the jet. Furthermore, it is practically impossible to generate high-speed jets of the mixtures at normal static temperatures because of the high stagnation temperatures required. Therefore, future studies will be made in a shock tube employing a transparent section for photochemical initiation of the shocked flowing gas. Detonation waves traveling through hydrogen-oxygen mixture in divergent channels maintain a constant speed although the pressure behind the wave decreases sharply. More experiments are underway to study this behavior. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-14807*# Pittsburgh Univ., Pa. Dept. of Earth and Planetary Sciences.
SOLAR WIND RADIATION DAMAGE EFFECTS IN LUNAR MATERIAL Lunar Sample Analysis Program. Final Technical Report
Bruce Hapke, Alvin J. Cohen, and William A. Cassidy 30 Nov. 1971 71 p refs
(Contract NAS9-9942)
(NASA-CR-115309) Avail: NTIS CSCL 03B

The research on solar wind radiation damage and other effects in lunar samples which was conducted to understand the optical properties of lunar materials is reported. Papers presented include: solar radiation effects in lunar samples, albedo of the moon, radiation effects in lunar crystalline rocks, valence states of 3rd transition elements in Apollo 11 and 12 rocks, and trace ferric iron in lunar and meteoritic titanaugites. F.O.S.

N72-14808*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTATION OF SOLAR WIND PARAMETERS FROM THE OGO-5 PLASMA SPECTROMETER DATA USING HERMITE POLYNOMIALS
Marcia Neugebauer 15 Dec. 1971 59 p refs
(Contract NAS7-100)
(NASA-CR-125063; JPL-TM-33-519) Avail: NTIS CSCL 03B

The method used to calculate the velocity, temperature, and density of the solar wind plasma is presented from spectra obtained by attitude-stabilized plasma detectors on the earth satellite OGO 5. The method, which used expansions in terms of Hermite polynomials, is very inexpensive to implement on an electronic computer compared to the least-squares and other iterative methods often used for similar problems. Author

N72-14809*# Harvard Coll. Observatory, Cambridge, Mass.
THEORETICAL AND EXPERIMENTAL STUDIES IN ULTRAVIOLET SOLAR PHYSICS Semiannual Status Report, 1 Feb. - 31 Jul. 1971

Leo Goldberg, W. H. Parkinson, and E. M. Reeves 31 Jul. 1971 17 p refs
(Grant NGL-22-007-006)
(NASA-CR-125059; SASR-17) Avail: NTIS CSCL 03B

Detailed descriptions are given of research progress on theoretical, instrumental, and spectroscopic ultraviolet solar physics. E.H.W.

N72-14810*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ULTRAVIOLET INVESTIGATIONS OF COSMIC X-RAY SOURCES AND ANALOGOUS OBJECTS Final Report
Hugh M. Johnson 31 Dec. 1971 4 p refs
(Contract NASw-1977)
(NASA-CR-125096) Avail: NTIS CSCL 04A

Data on the UV spectrum of the Crab nebula and on UV and radio frequency observations of Wolf-Rayet stars was analyzed. A description of TT Arietis is given. It is concluded that this object must be a double star, since it does not radiate like an ordinary photosphere or a single blackbody. Details of the spectrum are given. K.P.D.

N72-14811# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
STUDY OF ENERGETIC SOLAR PARTICLE EVENTS OF 18 NOVEMBER 1968, 25 FEBRUARY 1969 AND 30 MARCH 1969
F. Venkatarangan (Calgary Univ.), D. Venkatesan (Calgary Univ.), and J. A. VanAllen 1971 60 p refs
(Contract N00014-68-A-0196-0003)
(AD-729953; U-of-Iowa-71-27) Avail: NTIS CSCL 04/1

The solar particle events of November 18, 1968, February 25, 1969, and March 30, 1969 have been studied using data from the detector system aboard the lunar orbiting satellite Explorer 35. Protons, alpha particles, and nuclei are registered in the solid state detector of the system. An omnidirectional GM tube records protons. Included in the study are interplanetary propagation, particle anisotropy, and the intensity ratios of protons to alpha particles and of alpha particles to C,N,O nuclei above a common specific energy of 0.5 MeV/nucleon. The initial rise to maximum intensity and a portion of the decay phase for protons are in close agreement with diffusion models. At later times in all events, sections of the decay phase follow exponential laws. Author

N72-14347# Joint Publications Research Service, Washington, D.C.
MEASUREMENTS OF A FLUX OF CORPUSCLES WITH FOSFOR TYPE INSTRUMENTS
T. V. Kazachevskaya and A. I. Koryagin *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 27-37 refs (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

N72-14348# Joint Publications Research Service, Washington, D.C.
MEASURING THE ENERGY SPECTRUM OF ELECTRONS FLUX IN UPPER ATMOSPHERE
L. A. Antonova, G. S. Ivanov-Kholodnyy, and V. S. Medvedev *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1972 p 38-42 ref (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

N72-14349# Joint Publications Research Service, Washington, D.C.
INTENSITY OF CORPUSCULAR RADIATION AND SOLAR ACTIVITY
V. F. Tulinov, Yu. N. Moiseyev, I. G. Shapiro, and L. A. Ulanova *In its* Invest. of the Atmosphere and Ionosphere during Period of increased Solar Activity 16 Dec. 1971 p 43-48 refs (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

N72-14350# Joint Publications Research Service, Washington, D.C.
IONIZATION OF E REGION OF FLUXES OF OUTPOURING ELECTRONS
G. S. Ivanov-Kholodnyy and T. V. Kazachevskaya *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 49-54 refs (See N72-14344 05-13)
(UDC-551.510.535+537.56) Avail: NTIS

N72-14353# Joint Publications Research Service, Washington, D.C.
ON EFFECT OF SOLAR FLARE ON F2 LAYER OF IONOSPHERE
O. P. Kolomiytsev and A. A. Kuminov *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 77-86 refs (See N72-14344 05-13)
(UDC-551.510.535+523.745) Avail: NTIS

N72-14355# Joint Publications Research Service, Washington, D.C.
SOLAR AND GEOPHYSICAL ACTIVITY FROM 20 MARCH TO 24 APRIL 1969
Ye. V. Lavrova *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 102-116 (See N72-14344 05-13)
(UDC-551.510+523.745) Avail: NTIS

N72-14356# Joint Publications Research Service, Washington, D.C.
VARIATIONS IN INTENSITY OF CORPUSCULAR IONIZING RADIATION AND STATE OF IONOSPHERE
V. F. Tulinov, Yu. N. Moiseyev, I. G. Shapiro, and L. A. Ulanova *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 117-122 refs (See N72-14344 05-13)
(UDC-551.510.535) Avail: NTIS

N72-14357# Joint Publications Research Service, Washington, D.C.
EFFECT OF SOLAR FLARE ON IONIZATION OF F2-REGION
Yu. A. Romanovskiy *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 123-131 refs (See N72-14344 05-13)
(UDC-551.510) Avail: NTIS

N72-14359# Joint Publications Research Service, Washington, D.C.
ON REACTION OF STRATOSPHERE AND MESOSPHERE TO SPORADIC VARIATIONS IN SOLAR ACTIVITY
G. A. Kokin *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 141-148 refs (See N72-14344 05-13)
(UDC-551.510) Avail: NTIS

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-14812 California Univ., Los Angeles.
VARIABLE MASS DYNAMICS FOR ENGINEERING SYSTEMS Ph.D. Thesis
Stuart Bernard Belknap 1970 219 p
Avail: Univ. Microfilms Order No. 71-584

The systems considered are engineering vehicles or devices, including internal subsystems, composed of particles, distributed mass, flexible members, or fluid dynamic components. Translational and rotational motion relations are derived in a number of different forms with a variety of applications. The equations for rotational motion are referred to both an arbitrary, or body fixed point, and to the instantaneous center of mass of the system. Both angular momentum and angular velocity components are used as state variables. The equations of motion are written in forms applicable to a large class of rocket vehicles of current interest. Simplified motion equations are obtained which are descriptive of externally variable mass systems such as burning or ablating rigid bodies. Examples are presented which illustrate the procedure for expressing derived tensor relations as matrix differential equations in state variable form convenient for modern numerical simulation. Lagrange equations are developed applicable to variable mass systems. A discussion is presented concerning the relative convenience of Newton's laws and Lagrange's equations for producing system and subsystem equations of motion. A translational model system was analyzed in detail, as well as the model of a spinning rocket vehicle with a slight thrust misalignment. Dissert. Abstr.

N72-14813 Georgetown Univ., Washington, D.C.
RECTIFICATION AND DETERMINATION OF THE PHOTOMETRIC ELEMENTS OF THE W URSAE MAJORIS TYPE ECLIPSING BINARY STARS AK HERCULIS, FG HYDRAE, DK CYGNI, AB ANDROMEDAE, RZ TAURI, V839 OPHIUCHI, AND V566 OPHIUCHI Ph.D. Thesis
Carl S. Brown 1970 395 p
Avail: Univ. Microfilms Order No. 70-26663

Rectifications and the determination of photometric orbital and eclipse elements are presented for the following W Ursae Majoris type eclipsing binary stars: AK Herculis 5, 9, FG Hydrae 9, DK Cygni 5, 7, 9, AB Andromedae 5, RZ Tauri 5, V839 Ophiuchi 5, 7, and V566 Ophiuchi 5, 7, 9. The numbers following the systems indicate the number of Fourier coefficients carried in each rectification and solution. A least squares Fourier analysis is first performed on the individual observations outside eclipse solving separately for five, seven, nine, and eleven Fourier coefficients. A method is presented for machine computation of theoretical light curves in both the occultation and transit eclipses. The elements derived for each system depend on the number of Fourier coefficients carried in the rectification procedure. All of the computations have been performed on a high speed digital computer. The computer programs, written in Fortran 4, are presented in the appendix. Dissert. Abstr.

N72-14814 Georgetown Univ., Washington, D.C.
ON THE ACCURACY OF SOME CURRENT OBJECTIVE PRISM STELLAR RADIAL VELOCITIES Ph.D. Thesis
Frank Bartko, Jr. 1970 380 p
Avail: Univ. Microfilms Order No. 70-26668

A radial velocity study based on three high quality plates obtained with the normal field objective prism instrument is discussed. Kapetyn's Selected Area number 8 in Cassiopea is obtained on these plates showing predominately B and A type stars encompassing a range of useable magnitudes from about 6 to 10. The plates have been measured on a digitized Societe Genevoise comparator. The measurement procedure was designed to minimize systematic errors of measurement in the widely diverse spectra. The reduction of the measurements incorporated an astrometric-radial velocity approach and was effected by a least squares plate constant analysis. The results indicated no significant field corrections but a small magnitude error was found for a group of bright, early type stars such that a correction of +12 km/sec was necessary for stars brighter than 7.5. The plate errors both internal and external were found to be in agreement with other investigations and yield typical values of 8 and 12 km/sec. respectively. Dissert. Abstr.

N72-14815 Ohio State Univ., Columbus.
A STUDY OF INTRINSIC POLARIZATION IN Be STARS Ph.D. Thesis
Robert Leland Bottemiller 1970 126 p
Avail: Univ. Microfilms Order No. 70-26253

Polarimetric observations of Be stars have been obtained in order to investigate the possible existence of intrinsic polarization. Visual binary systems were observed with one member a Be star of high observed rotational velocity, assumed to maximize the probability of intrinsic polarization, and the other member with a low observed rotational velocity. The latter component, with little or no intrinsic polarization, provides a measure of any interstellar polarization arising along the line of sight from the stellar system to the observer. The single most striking result is the lack of a similar wavelength dependence among the objects studied. Dissert. Abstr.

N72-14816 Yale Univ., New Haven, Conn.
AN ANALYTICAL COMPARISON OF NEWTONIAN AND RELATIVISTIC PLANETARY ORBIT Ph.D. Thesis
Pasquale Bernard Esposito 1970 159 p
Avail: Univ. Microfilms Order No. 70-25088

This analysis encompasses a thorough investigation of various formulations and solutions of the Relativistic One Body Problem (R1BP). In brief, this problem consists of describing the motion of a body of negligible mass, moving in a static and spherically symmetric gravitational field of a massive body, subject to the laws of Einstein's theory of general relativity. The mathematical specification of the problem is in canonical form with Delaunay variables and the proper time is the independent variable. Based upon the concepts of the classical theory of Hamilton-Jacobi and the method of von Zeipel along with several significant new contributions, Hori has developed a perturbation method for solving differential equations. This technique was applied and the solution of the R1BP deduced. Expressions derived for the Delaunay variables consist of all first-order terms and secular terms of the second order. Furthermore, these equations have a concise and simple form and therefore are easily adapted to applications. Several hypothetical cases were constructed and a numerical integration of the equations of motion was performed. Dissert. Abstr.

N72-14817 Princeton Univ., N.J.
ON THE COALESCENCE OF COLLIDING STARS IN DENSE STELLAR SYSTEMS Ph.D. Thesis
Robert Hugh Sanders 1970 57 p
Avail: Univ. Microfilms Order No. 70-23633

Effects of stellar collisions, such as mass and energy losses, and the question of whether or not two colliding stars coalesce to form a more massive star are investigated by numerical calculations utilizing a simple physical model. The results of these calculations are applied by Monte Carlo techniques in a computer simulation of dense stellar systems in order to follow the distribution of stellar masses as the systems evolve. The supernovae rate from coalesced stars systems is incapable of explaining Seyfert galaxy or quasar luminosities. Dissert. Abstr.

N72-14818 Rochester Univ., N.Y.
HIGH-VELOCITY CLOUD COLLISIONS Ph.D. Thesis
Tai-Low Chow 1970 102 p
Avail: Univ. Microfilms Order No. 71-1376

A critical examination of the consequences when high momentum inflowing extragalactic gas clouds collide with galactic gases is presented. A one-dimensional plane parallel flow is employed. The extragalactic gas cloud is taken to be homogeneous and the galactic gas is roughly represented by Oort's barometric formula. Oort further assumes that the layer ends at z = 600 pc, beyond which lies the galactic corona. The collisions are assumed to occur at this height and after collision two strong shocks appear running away from the contact surface, into galactic and extragalactic gases respectively. The cooling time, velocity, and other properties of the gas which recombines after ionization are investigated. The solutions, on a characteristic grid,

of the one-dimensional hydrodynamic equations subject to the shock conditions were obtained for an initial density ratio of unity at t=0. This model appears entirely consistent with the observations to date. Dissert. Abstr.

N72-14819 Texas Univ., Austin.
COMPACT GALAXIES Ph.D. Thesis
Anthony Patrick Fairall 1970 199 p
Avail: Univ. Microfilms Order No. 71-122

An observational investigation, chiefly involving image tube spectroscopy at McDonald Observatory, has been carried out on a category at galaxies described as compact. The red compacts, those having images on the red Sky Survey plates stronger than on the blue and which account for 59% of the compacts found from the Sky Survey, show composite spectra of medium to late type stars. They typically have diameters of the order of a few kiloparsecs and absolute photographic magnitudes around -19. There appears to be a tendency for compacts (chiefly tl) red ones) to occur in multiple systems, in particular pairs of nearly equal components are common. Three multiple systems were involved in the spectroscopic investigation, but no conclusive results were obtained concerning their structure or formation.
Dissert. Abstr.

N72-14820 Georgetown Univ., Washington, D.C.
MIE SCATTERING CALCULATIONS OF THE CONTRIBUTION OF ATMOSPHERIC AEROSOLS TO THE MARTIAN OPPOSITE EFFECT Ph.D. Thesis
Jaylee Montague Mead 1970 84 p
Avail: Univ. Microfilms Order No. 70-26677

The Mie theory is used to compute integrated scattering intensities for spherical submicron aerosol particles with various indices of refraction and several size distributions in an effort to determine if the presence of atmospheric aerosols can account for the Martian opposition effect. The calculations show that neither substances having a refractive index between 1.20 and 1.50, which include ice, water, and solid CO2, nor highly absorbing materials, such as limonite, can produce the opposition effect. On the other hand, aerosols having little or no absorption, such as meteoric particles or suspended surface dust composed of semitransparent minerals, do exhibit a definite increase in reflectivity at small phase angles. Dissert. Abstr.

N72-14821 Ohio State Univ., Columbus.
OBSERVED AND PREDICTED INTENSITIES OF ABSORPTION LINES IN MIRA VARIABLES Ph.D. Thesis
Synnoeve Voss Morris 1970 90 p
Avail: Univ. Microfilms Order No. 70-26334

Thirty-five high dispersion sion spectra of M-type stars were evaluated, both normal giant stars of type M and Mira stars of corresponding spectral types were considered. Equivalent line widths were measured on all of the spectrograms in the wavelength region 3980-4500 of as many unblended atomic features as possible, the maximum number in any star being 51 such features. From these measurements it was concluded that there is in the Mira stars both a general and selective weakening of atomic features. However, the degree of the general and selective weakening varies from star to star. Two indices, GW for the general line weakening and SW for the selective line weakening, were computed for the 18 Mira stars in the survey.
Dissert. Abstr.

N72-14822 California Univ., Berkeley.
OBSERVATIONS OF QUASI-STELLAR SOURCES AND RADIO GALAXIES AT MILLIMETER WAVELENGTHS Ph.D. Thesis
John Daniel Gray Rather 1970 161 p
Avail: Univ. Microfilm · Order No. 71-835

Fluxes of 49 extragalactic objects were measured at wavelengths near 8 millimeters and 1.2 centimeters. Signal to noise radios greater than 4 were attained for 21 of the sources, greater than 3 for 28 sources, and greater than 2 for 35 sources inclusive. The list of all objects observed includes 28 quasi-stellar objects, 5 Seyfert galaxies, 5 unidentified variable radio sources, 4 BSO's, 3 D galaxies, 1 N galaxy, and 3 miscellaneous objects. Spectral indices were compared with results from longer wavelengths. Many of the sources observed tend toward increasingly positive spectral index at millimeter wavelengths. Weaker quasi-stellar sources appear to have more positive curvature indices than stronger ones. A description of the operation of the 20-foot telescope used is included, together with a discussion of the pointing survey and the overall accuracy of the observations. Dissert. Abstr.

N72-14823 Texas Univ., Austin.
NEWTONIAN HIERARCHIAL COSMOLOGY Ph.D. Thesis
James Richard Wertz 1970 148 p
Avail: Univ. Microfilms Order No. 71-209

A continuous representation for the description of a Hierarchical universe is introduced. General solutions for the evolution of Hierarchical models are set forth for both continuous and discrete representations. The Big Bang Hierarchy is analyzed in some detail, leading to the Hubble Law previously mentioned and the fact that these models have a homogeneous mass distribution at their earliest stages. Their recent history is also analyzed, principally for the discussion of tides, which cause the major distortion from the simple evolutionary picture. A variety of criteria for the instantaneous Hierarchical structure are developed which limit the degree of tidal distortion. A model for tidal evolution is presented and analyzed. Methods of approach to a General Relativistic treatment and the problem of the propagation of light are presented. Questions of the uniqueness of the present epoch, agreement with the microwave background, and causality are discussed briefly. Dissert. Abstr.

N72-14824*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SKYLAB 4 PRELIMINARY REFERENCE EARTH RESOURCES EXPERIMENT PACKAGE (EREP) PASS PLANNING DOCUMENT. VOLUME 1: GROUNDTRACKS
Alfred N. Lunde 3 Jun. 1971 169 p refs
(NASA-TM-X-67451; MSC-IN-71-FM-210-Vol-1; MSC-04369-Vol-1) Avail: NTIS CSCL 22C

Ground tracks and some ground track-associated parameters of the Skylab 4 (SL-4) mission are presented for a rapid evaluation and determination of EREP passes. The data are based on an SL-1 launch at 17h 30m 0.00s Greenwich mean time on 30 April 1973. Author

N72-14825*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SKYLAB 3 PRELIMINARY REFERENCE EARTH RESOURCES EXPERIMENT PACKAGE (EREP) PASS PLANNING DOCUMENT. VOLUME 2: EREP SITES AND S190 SWATH STUDY OF SELECTED REVS
Alfred N. Lunde 8 Jun. 1971 164 p refs
(NASA-TM-X-67453; MSC-71-FM-219; MSC-04354-Vol-2)
Avail: NTIS CSCL 22C

The ground tracks and S190 swaths are presented of selected revolutions over areas containing earth resources experiment package (EREP) sites. The following eight EREP disciplines are shown: sensor performance evaluation, forestry, geology, hydrology, land use mapping, oceanography, pollution, and weather. Most of the data reported consists of passes over the continental United States. F.O.S.

N72-14826*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SKYLAB 4 PRELIMINARY REFERENCE EARTH RESOURCES EXPERIMENT PACKAGE (EREP) PASS PLANNING DOCUMENT. VOLUME 2: EREP SITES AND S190 SWATH STUDY OF SELECTED REVS
Alfred N. Lunde 3 Jun. 1971 152 p refs
(NASA-TM-X-67452; MSC-IN-71-FM-216-Vol-2;

MSC-04369-Vol-2) Avail: NTIS CSCL 22C

Ground tracks with s190 swaths of selected revolutions as they pass over areas containing EREP sites are presented. Most of the data consists of passes over the continental United States; several are shown over Australia and South America. The S190 is a 6-channel high precision 70 mm camera facility.

Author

N72-14827*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

DETAILED SKYLAB ECS CONSUMABLES ANALYSIS FOR THE INTERIM REVISION FLIGHT PLAN (NOVEMBER, 1972, SL-1 LAUNCH)

Cynthia Wells and Harry E. Kolkhorst 1 Jun. 1971 157 p refs (NASA-TM-X-67454; MSC-IN-71-FM-202; MSC-04348) Avail: NTIS CSCL 22C

The consumables analysis was performed for the Skylab 2, 3, and 4 Preliminary Reference Interim Revision Flight Plan. The analysis and the results are based on the mission requirements as specified in the flight plan and on other available data. The results indicate that the consumables requirements for the Skylab missions allow for remaining margins (percent) of oxygen, nitrogen, and water nominal as follows: 83.5, 90.8, and 88.7 for mission SL-2; 57.1, 64.1, and 67.3 for SL-3; and 30.8, 44.3, and 46.5 for SL-4. Performance of experiment M509 as scheduled in the flight plan results in venting overboard the cluster atmosphere. This is due to the addition of nitrogen for propulsion and to the additional oxygen introduced into the cabin when the experiment is performed with the crewman suited.

Author

N72-14828*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

METEOROID ACTIVITY ON THE LUNAR SURFACE FROM THE SURVEYOR 3 SAMPLE EXAMINATION

B. G. Cour-Palais, H. A. Zook, and R. E. Flaherty Nov. 1971 32 p refs Presented at the 14th Plenary Meeting COSPAR, Seattle, Jun. 1971

(NASA-TM-X-58079) Avail: NTIS CSCL 03B

The Surveyor 3 television camera shroud and polished aluminum tube, retrieved as a result of the Apollo 12 mission after 2-1/2 years on the lunar surface, were examined at the NASA Manned Spacecraft Center for evidence of meteoroid impact. The results of this examination were compared with other estimates of the meteoroid flux in the lunar vicinity and are shown to be in good agreement with the Lunar Orbiter penetration rates. In addition, the relationship between a derived lunar surface meteoroid cumulative-flux model and the comparable near-earth model is discussed in the light of theoretical predictions. It is shown that the effect of the gravitational field of the earth on the near-earth environment was greater than previously predicted. The implication is that the average meteoroid velocity relative to the earth is probably 17 km/s. The many low velocity impacts on the Surveyor 3 camera and tube are shown to be of lunar surface origin and to be primarily the result of rocket exhaust interaction.

Author

N72-14829*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

NAVIGATION ANALYSIS FOR VIKING 1979, OPTION B

Paul H. Mitchell 3 Jun. 1971 91 p refs

(NASA-TM-X-67449; MSC-04373; MSC-IN-71-FM-212) Avail: NTIS CSCL 22C

A parametric study performed for 48 trans-Mars reference missions in support of the Viking program is reported. The launch dates cover several months in the year 1979, and each launch date has multiple arrival dates in 1980. A plot of launch versus arrival dates with case numbers designated for reference purposes is included. The analysis consists of the computation of statistical covariance matrices based on certain assumptions about the ground-based tracking systems. The error model statistics are listed in tables. Tracking systems were assumed at three sites: Goldstone, California; Canberra, Australia; and Madrid, Spain. The tracking data consisted of range and Doppler measurements taken during the tracking intervals starting at E-30(d) and ending at E-10(d) for the control data and ending at E-18(h) for the knowledge data. The control and knowledge covariance matrices were delivered to the Planetary Mission Analysis Branch for inputs into a delta V dispersion analysis.

Author

N72-14830*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ABSOLUTE ULTRAVIOLET SPECTROPHOTOMETRY OF: alpha CMa, gamma ORI, kappa ORI, AND alpha LEO; AND A CONTINUING CALIBRATION PROGRAM AND SOME PRELIMINARY RESULTS

Dennis C. Evans Jul. 1971 18 p refs

(NASA-TM-X-65784; X-672-71-492) Avail: NTIS CSCL 03A

Spectral observations of the stars alpha CMa, gamma Ori, kappa Ori, and alpha Leo have been obtained in the range 1150 to 4000 Angstroms, using rocket borne spectrometers. The payloads have a 13-inch diameter telescope, a rotatable concave diffraction grating, and three pulse counting photomultiplier photometers. The laboratory standards used as photometric references derive their primary calibration directly or indirectly from the National Bureau of Standards. An error range of up to + or - 10 percent is attributed to these laboratory standards; + or - 8 percent to the calibration procedure; and + or - 10 percent is assigned as an accidental error range.

Author

N72-14831*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE UNITED STATES SOUNDING ROCKET PROGRAM

Jul. 1971 63 p refs

(NASA-TM-X-65777; X-740-71-337) Avail: NTIS CSCL 22B

The United States sounding rocket program is discussed. The program is concerned with the fields of solar physics, galactic astronomy, fields and particles, ionospheric physics, aeronomy, and meteorology. Sounding rockets are described with respect to propulsion systems, gross weight, and capabilities. Instruments used to conduct ionospheric probing missions are examined. Results of previously conducted sounding rocket missions are included.

Author

N72-14832*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ORBITAL RADIATION EXPOSURE OF THE ASTRONOMICAL NETHERLANDS SATELLITE (ANS)

E. G. Stassinopoulos Nov. 1971 26 p refs Submitted for publication

(NASA-TM-X-65782; X-601-71-485) Avail: NTIS CSCL 22C

The orbital electron and proton flux calculations were performed for determining the applicability of COS/MOS ciruits for the ANS computer and X-ray experiment logic. The results for electrons, protons, and the total lifetime the satellite spends in flux-free regions are presented in tables and graphs.

N.E.N.

N72-14833*# Rice Univ., Houston, Tex. Space Science Dept.

INVESTIGATION OF BRIGHT SOURCES OF FAR INFRARED RADIATION Semiannual Report

Frank J. Low, Doyle A. Harper, Jr., and Carlton M. Gillespie, Jr. 1 Jun. 1970 27 p refs Sponsored in part by NASA

(Contract F19628-69-C-0302; ARPA Order 1366; AF Proj. 8692)

(NASA-CR-125430; DoD-Element-62301D; AD-725063; AFCRL-71-0160; SATR-2) Avail: NTIS CSCL 09B

The flying Infrared Telescope has been operational during the six-month period ending 31 May 1970 with twenty-eight high altitude missions being flown. The total infrared luminosities were measured of the galactic center and the Seyfert galaxy NGC-1068, the first extragalactic object to be observed at far-infrared wavelengths. Likewise, the galactic nebula M-17 and the IR object(s) in the Orion nebula have been observed. Observations of the planets Jupiter, Saturn, Mars and Venus

were made at several wavelength intervals between 60 microns and 300 microns. Author

N72-14834# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 266
15 Dec. 1971 107 p refs Transl. into ENGLISH from Russian reports
(JPRS-54704) Avail: NTIS

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N72-14835# Minnesota Univ., Minneapolis.
PROPER MOTION SURVEY WITH THE FORTY-EIGHT INCH SCHMIDT TELESCOPE: THE ZONES PLUS 66 AND PLUS 60, 6h TO 20h
Willem J. Luyten 30 Sep. 1971 196 p
(Grants NSF GP-8082; NSF GP-9506; NSF GP-23509)
Avail: NTIS

A catalog is presented of all the stars found in the +66 and +60 zones, to which are added all the stars from the +72 zone whose declinations are south of +70 and are between the limits of right ascension of the present zones. The catalog contains 17,418 entries, of which 888 are B.D stars, 334 are stars first announced by others, and 16,196 are stars found in the Bruce and Palomar Surveys. Each entry consists of the LP designation, 1950 position, photographic magnitude, spectral or estimated color class, and total annual proper motion and its direction.
N.E.N.

N72-14836# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TASS REPORT: MARS: COMPLEX INVESTIGATIONS. SOFT LANDING ON THE PLANET SURFACE
[1971] 14 p Transl. into ENGLISH from Pravda (USSR), no. 353(19496), 19 Dec. 1971
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The flights of Mars 2 and Mars 3 in 1971 and the scientific investigations made by their instruments are described. The scientific studies included data gathering on the following: interplanetary medium and magnetic field, solar wind flow around the planet and interaction with the ionosphere, intensity of electron motion near Mars, atmospheric temperature and pressure, surface features, and infrared, visible, and ultraviolet spectral data. The fundamental stages in the two flights, including the Mars 3 landing, are outlined, along with the more important subsystems. N.E.N.

N72-14837*# Bellcomm, Inc., Washington, D.C.
DENSITY AND FLUX DISTRIBUTIONS IN THE LUNAR ATMOSPHERE DUE TO POINT AND LINE SOURCES
T. T. J. Yeh and G. K. Chang 28 Oct. 1971 27 p refs
(Contract NASw-417)
(NASA-CR-124754; TM-71-2015-7; Case-340) Avail: NTIS CSCL 03B

Apart from the globally distributed ambient gases in the lunar atmosphere, localized gas sources, such as volcanos, may have a measurable effect on the process of shaping the lunar atmosphere. Analytic solutions were obtained for the spatial distributions of neutral gas densities and fluxes due to point and line sources at the lunar surface. Both density and flux profiles are strong functions of the distance from the source to the point of observation. The study also reveals that: (1) The location of the source may be identified from the density and flux profiles. (2) If the gas species is known, the temperature of the gas may be determined from the density gradient at a distance of several scale heights from the source. (3) The strength of the gas source may be determined by the magnitudes of density and flux.
Author

N72-14838*# Bellcomm, Inc., Washington, D.C.
EMPIRICAL ORBIT DETERMINATION USING APOLLO 14 DATA
A. J. Ferrari and M. V. Bullock 1 Oct. 1971 16 p ref
(Contract NASw-417)
(NASA-CR-124755; B71-10001; Case-310) Avail: NTIS CSCL 22C

An empirical orbit determination method is shown to yield highly accurate navigation results when applied to lunar orbit tracking data. Regressions and predictions of free flight Apollo 14 tracking data exhibit minimal residual growth, and the solution orbital elements behave in a very consistent manner. Solutions from data acquired during propulsive maneuvers result in degraded predictions. The residual patterns from free flight processing are shown to be consistent from pass to pass and are correlated with lunar topographic features. Author

N72-14839*# Bellcomm, Inc., Washington, D.C.
LUNAR CONDUCTIVITY MODELS FROM THE APOLLO 12 MAGNETOMETER EXPERIMENT
W. R. Sill 22 Oct. 1971 27 p refs
(Contract NASw-417)
(NASA-cr-124758; TM-71-2015-9; Case-340) Avail: NTIS CSCL 03B

A number of conductivity models were investigated for compatibility with Apollo 12 magnetometer data. Except at the highest frequencies, a simple core-crust model is compatible with the observed dayside transfer function, which is expressed as the ratio of the lunar surface field spectrum to the interplanetary magnetic field spectrum. All conductivity profiles exhibit a peak near 1500 km, when the models are constrained to conform to the observed flat response at the higher frequencies. However, at frequencies above .01 Hz the long wavelength limitation of the theoretical model is no longer valid. A plausible explanation for the difference between the north-south and east-west transfer functions is that it is due to a time-varying compression of the remanent (dc) field at the Apollo 12 site by fluctuations in the solar wind plasma. Author

N72-14840*# Bellcomm, Inc., Washington, D.C.
LUNAR GRAVITY DERIVED FROM LONG-PERIOD SATELLITE MOTION, A PROPOSED METHOD
A. J. Ferrari 29 Nov. 1971 47 p refs
(Contract NASw-417)
(NASA-CR-124759; TM-71-2014-6; Case-310) Avail: NTIS CSCL 22A

A method was devised to determine the spherical harmonic coefficients of the lunar gravity field. The method consists of a two-step data reduction and estimation process. Pseudo-Doppler data were generated simulating two different lunar orbits. The analysis included the perturbing effects of the L1 lunar gravity field, the earth, the sun, and solar radiation pressure. Orbit determinations were performed on these data and long-period orbital elements were obtained. The Kepler element rates from these solutions were used to recover L1 lunar gravity coefficients. Overall results of the experiment show that lunar gravity coefficients can be accurately determined and that the method is dynamically consistent with long-period perturbation theory.
Author

N72-14841*# Applied Research Labs., Goleta, Calif. Hasler Research Center.
ION MICROPROBE MASS ANALYSIS OF LUNAR SAMPLES. LUNAR SAMPLE PROGRAM Progress Report
C. A. Anderson and J. R. Hinthorne [1971] 36 p refs
(Contract NAS9-11566)
(NASA-CR-115303) Avail: NTIS CSCL 03B

Mass analyses of selected minerals, glasses and soil particles of lunar, meteoritic and terrestrial rocks have been

made with the ion microprobe mass analyzer. Major, minor and trace element concentrations have been determined in situ in major and accessory mineral phases in polished rock thin sections. The Pb isotope ratios have been measured in U and Th bearing accessory minerals to yield radiometric age dates and heavy volatile elements have been sought on the surfaces of free particles from Apollo soil samples. Author

N72-14842*# Meret Co., Los Angeles, Calif.
GEMINI EXPERIMENT S026
David B. Medved [1971] 565 p refs
(Contract NAS9-10685)
(NASA-CR-115313; S026) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

The results of the reduction and analysis of data obtained from the S026 experiment from Gemini 10 and 11 flights are presented. The electron and ion sensors were continuously operative throughout both missions from shroud removal (about 6 minutes after Agena liftoff to power-down conditions one week later). Data on ion and electron currents, electron temperature, and vehicle potential were obtained at a sample rate of 32 times per second on positive ions for each of two ion sensors and once every 1.067 seconds for the electron sensor. Only the data reduction of the Gemini plasma wake measurements comprising roughly twenty minutes of data for six maneuvers programed for wake measurements are considered. The intermediate depletion zone, between 1 and 10 vehicle radii downstream from the object, is emphasized. The smallest characteristic radius of interest is 1.34 feet and the largest is 5 feet. This implies a separation span extending from approximately 1.5 feet at the closest approach to at least 50 feet into the far field. Author

N72-14843*# Techtran Corp., Glen Burnie, Md.
THE WAVELENGTH DEPENDENCE OF ATMOSPHERIC EXTINCTION
J. Wempe Washington NASA Oct. 1971 43 p refs Transl. into ENGLISH from Astron. Nachr. (Kiel), v. 275, no. 1, 1947 p 1-22
(Contract NASw-2037)
(NASA-TT-F-13884) Avail: NTIS CSCL 03B

The spectral gradients of monochromatic extinction coefficients which were studied under various atmospheric conditions show a strong correlation with visual extinction. Fog extinction obtained by subtracting from the total extinction the components due to molecular scattering of the permanent gases and the selective absorption by ozone may be expressed by beta/lambda (alpha), with the exponent alpha = 1.5 at Jena and 0.6 to 1.5 at other locations, independent of haze, and beta, a measure of the total mass of haze in the atmosphere. Author

N72-14844*# Scientific Translation Service, Santa Barbara, Calif.
EXPLORER 42, UHURU, 1970-101A
P. Koubsky Washington NASA Nov. 1971 8 p Transl. into ENGLISH from Aviation and Astronaut. (Czechoslovakia), 1971 p 23/523-24/524
(Contract NASw-2035)
(NASA-TT-F-13887) Avail: NTIS CSCL 22C

The equipment, auxiliary systems, and the X-ray experiments performed onboard the Explorer 42 UHURU satellite are described. Author

N72-14845*# National Aeronautics and Space Administration, Washington, D.C.
UK-4
Joseph J. McRoberts 26 Nov. 1971 13 p refs
(NASA-News-Release-71-227) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22A

The launch of the UK-4 satellite (United Kingdom) and its expected operations in the upper ionosphere are discussed. The satellite is designed to study radio noise, low frequency radio waves, electron temperature, and count low energy charged particles. E.H.W.

N72-14846*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SOIL MECHANICS RESULTS OF LUNA 16 AND LUNOKHOD 1: A PRELIMINARY REPORT
Stewart W. Johnson and W. David Carrier, III 9 Jun. 1971 13 p refs
(NASA-TM-X-67566; MSC-SM-71-3) Avail: NTIS CSCL 03B

The physical and mechanical properties of the lunar soil, as determined by Luna 16 and Lunokhod 1 experiments, are discussed. Data are included for interactions between vehicle wheels and the lunar soil, compressibility, resistance to penetration, and friction characteristics of the soil. The shear strength of the returned lunar soil for various bulk densities is also examined. Several potential spacecraft materials were tested in contact with lunar soil to determine their friction and wear characteristics. E.H.W.

N72-14847# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 267
30 Dec. 1971 102 p refs Transl. into ENGLISH from various Soviet bloc publications
(JPRS-54831) Avail: NTIS

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy, and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N72-14848*# Scripta Technica, Inc., Washington, D.C.
A DETERMINATION OF THE PARAMETERS OF THE VENUSIAN ATMOSPHERE AT THE AVERAGE SURFACE LEVEL FROM RADIOASTRONOMICAL AND RADAR MEASUREMENTS
Yu. N. Vetukhnovskaya, A. D. Kuzmin, A. P. Naumov, and T. V. Smirnova Washington NASA Jun. 1971 16 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 48, no. 1, 1971 p 146-156
(Contract NASw-2036)
(NASA-TT-F-13858) Avail: NTIS CSCL 03B

Three independent estimates were made of conditions in the lower Venusian atmosphere on the basis of results of radioastronomical measurements of the brightness temperature spectrum, polarization and radar reflection cross section and measurement data from the Venus 4, 5 and 6 space probes. These estimates lead to two internally consistent models: an adiabatic model and an isothermal model. It is shown that the water vapor content in the atmosphere is nearer the lower limit, measured by the Venus series of probes, than the upper limit. The water content in the cloud layer is estimated. Author

N72-14849*# Arizona Univ., Tucson. Field Emission and Space Systems Lab.
DETECTION TECHNIQUES FOR TENUOUS PLANETARY ATMOSPHERES Semiannual Report, 1 Jul. - 31 Dec. 1971
Stuart A. Hoenig 31 Dec. 1971 39 p refs
(Grant NGL-03-002-019)
(NASA-CR-124911; SAR-17) Avail: NTIS CSCL 03B

The development of new types of detectors for analysis of planetary atmospheres is discussed. Initially, the interest was in detectors for use under partial vacuum conditions. The program has been extended to include detectors for use at one atmosphere and adsorption system for control and separation of gases. Results to date have included detectors for O2 and H2 under partial vacuum conditions. Experiments on detectors for use at high pressures began in 1966, and systems for CO, H2,

and O2, were reported. Electrically controlled adsorbent was developed. It was demonstrated that under proper conditions a thin film of semiconductor material could be electrically cycled to adsorb and desorb a specific gas. This work was extended to obtain quantitative data on the use of semiconductors as controllable adsorbents. Author

N72-14850*# Scripta Technica, Inc., Washington, D.C.
NUMERICAL MODELING OF HEAT TRANSFER BY RADIATION AND CONVECTION IN THE VENUSIAN ATMOSPHERE
V. S. Avduyeskiy, F. S. Zavelevich, M. Ya. Marov, A. I. Noikina, and Polezhayev NASA Oct. 1971 17 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 2, 1971 p 280-291
(Contract NASw-2036)
(NASA-TT-F-13869) Avail: NTIS CSCL 03B

An approximate analysis of heat transfer in the Venusian atmosphere is presented. The radiant fluxes are calculated, and a model of convective flow is developed for the lower layer of the atmosphere; the fraction radiative and convective transport in the overall thermal balance of the planet are estimated. Author

N72-14851*# Scientific Translation Service, Santa Barbara, Calif.
ON RADIATIVE HEAT TRANSPORT IN THE ATMOSPHERE OF VENUS UNDER THE CLOUDS
G. M. Strelkov Washington NASA Jul. 1971 6 p refs Transl. into ENGLISH from Kosmich. Issled., Akad. Nauk SSSR (Moscow), v. 9, no. 2, 1971 p 311-313
(Contract NASw-2035)
(NASA-TT-F-13868) Avail: NTIS CSCL 03B

The high surface temperature of the planet Venus is discussed. The greenhouse effect, caused by the radiative heat transport in the convective lower atmosphere of the planet, is considered. The data show that the mechanism of radiative heat transport on Venus does not provide an escape mechanism into interplanetary space for the energy received from the sun. The conclusions are: (1) high surface temperatures are created by the greenhouse effect and (2) heat transport in the atmosphere of Venus beneath the clouds is due to convective and turbulent mechanisms. Author

N72-14852*# North American Rockwell Corp., Downey, Calif. Space Div.
REMOTE SENSOR SUPPORT REQUIREMENTS FOR PLANETARY MISSIONS Summary Report
J. B. Weddell and A. E. Wheeler Jun. 1971 98 p refs
(Contract NAS2-5647)
(NASA-CR-114404; SD-71-487) Avail: NTIS CSCL 22A

The study approach, methods, results, and conclusions of remote sensor support requirements for planetary missions are summarized. Major efforts were made to (1) establish the scientific and engineering knowledge and observation requirements for planetary exploration in the 1975 to 1985 period; (2) define the state of the art and expected development of instrument systems appropriate for sensing planetary environments; (3) establish scaling laws relating performance and support requirements of candidate remote sensor systems; (4) establish fundamental remote sensor system capabilities, limitations, and support requirements during encounter and other dynamical conditions for specific missions; and (5) construct families of candidate remote sensors compatible with selected missions. It was recommended that these data be integrated with earlier results to enhance utility, and that more restrictions be placed on the system. Author

N72-14853*# North American Rockwell Corp., Downey, Calif. Space Div.
SUPPORT REQUIREMENTS FOR REMOTE SENSOR SYSTEMS ON UNMANNED PLANETARY MISSIONS. APPENDIX A: SUPPORT REQUIREMENT SUMMARY TABLES, PHASE 3
Jun. 1971 144 p ref
(Contract NAS2-5647)
(NASA-CR-114405; SD-70-375-2-App-A) Avail: NTIS CSCL 22A

An appendix containing one page summary tables of sensor observation objectives, measurement capabilities, support requirments, and worth values is presented. Tables are arranged according to (1) sensor type number, (2) flyby mission number, (3) for multi-planet missions, in order of increasing distance from the sun, (4) for orbiter mission, by planets in order of increasing distance from the sun, and (5) by orbit number. Author

N72-14854*# North American Rockwell Corp., Downey, Calif. Space Div.
SUPPORT REQUIREMENTS FOR REMOTE SENSOR SYSTEMS ON UNMANNED PLANETARY MISSIONS, PHASE 3
Jun. 1971 216 p refs
(Contract NAS2-5647)
(NASA-CR-114403; SD-70-375-1) Avail: NTIS CSCL 22A

The results of a study to determine the support requirements for remote sensor systems on unmanned planetary flyby and orbiter missions are presented. Sensors and experiment groupings for selected missions are also established. Computer programs were developed to relate measurement requirements to support requirements. Support requirements were determined for sensors capable of performing required measurements at various points along the trajectories of specific selected missions. Author

N72-14855# Academy of Sciences (USSR), Moscow. Inst. of Applied Mathematics.
ON THE NATURE OF HIGH VELOCITIES OF H2O SOURCES IN W49
V. S. Strelnitsky and R. A. Sunyaev 1971 16 p refs
Avail: NTIS

With the observed high radial velocity dispersion, the system of H2O sources in W59 is shown to be dynamically unstable. It is also shown that the cause of their flying away appeared not more than 1000 years ago. The most likely model of the sources is a flying away system of light dense clouds of neutral gas around a hot supergiant or a massive protostar. Possible mechanisms of acceleration of the clouds are discussed: steller wind, rocket mechanism and radiation pressure from the central object. Possible connection between the acceleration mechanism and the pumping of the maser is pointed out.
author

N72-14856*# Martin Marietta Corp., Denver, Colo.
LANDER TRAJECTORY RECONSTRUCTION COMPUTER PROGRAM Final Report, 29 Jun. - 12 Dec. 1971
G. L. Adams, A. J. Bradt, J. B. Ferguson, and H. J. Schnelker Dec. 1971 417 p refs
(Contract NAS5-11873)
(NASA-CR-122329; MCR-71-321) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

The Lander Trajectory Reconstruction (LTR) computer program is a tool for analysis of the planetary entry trajectory and atmosphere reconstruction process for a lander or probe. The program can be divided into two parts: (1) the data generator and (2) the reconstructor. The data generator provides the real environment in which the lander or probe is presumed to find itself. The reconstructor reconstructs the entry trajectory and atmosphere using sensor data generated by the data generator and a Kalman-Schmidt consider filter. A wide variety of vehicle and environmental parameters may be either solved-for or considered in the filter process. Author

N72-14857# California Inst. of Tech., Pasadena.
ESTIMATION OF MASSES OF INDIVIDUAL GALAXIES IN CLUSTERS OF GALAXIES
Richard A. Wolf and John N. Bahcall [1971] 53 p refs

Prepared in cooperation with Rice Univ., Houston, Tex.
(Contract AT(11-1)-68)
(CALT-68-X-4) Avail: NTIS

Expressions are derived that enable the placement of approximate limits on the mass of an individual galaxy or quasi-stellar object that is a member of a group or cluster of galaxies. Two basically different approaches are used. First, a perturbation method is used to derive expressions that give approximate limits on the mass of any observed object in a cluster, providing only that the positions of cluster galaxies around the unknown mass are measured and redshifts are known for several galaxies in the cluster. Second, the method developed by Page is extended to give approximate mass limits for any bound pair of galaxies whose positions and redshifts are known. For each approach, the uncertainties in the mass estimates, arising from both observational and statistical effects, are estimated analytically. An upper estimate, which is 80% certain to be greater than the actual mass of the galaxy, can be obtained in every case. A best guess, which is at least 50% certain to be greater than the actual mass of the galaxy, and a lower estimate, which is 80% certain to be less than the actual galaxy mass, can be obtained in some cases. Author (NSA)

N72-14858# European Space Research Inst., Frascati (Italy).
GRAVITATIONAL SLOWING DOWN OF RIGID SPINNING BODIES
Bruno Bertotti and Marcello Anile (Catania Univ., Italy) Oct. 1971 26 p refs Submitted for publication
(ESRIN-IN-126-Rev) Avail: NTIS

A rigid body endowed with a quadrupole momentum is subject to a torque due to gravitation wave and emission and slows down until it stops or until the rotation axis is aligned with the axis of symmetry. In the latter situation, the braking index increases monotonously from 5 to infinity. When no symmetry is present, the index may be lower than 5 only within a very small region around a point on the equator, the lowest possible minimum being about 3.25. The asymptotic state corresponds to $k = 5$ and to an axis of rotation parallel to the least asymmetric principal axis or to a point on the equator, according to the degree of asymmetry. The situation in which the free nutation is important is also discussed. Author (ESRO)

N72-14859# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF COSMOS 219 ROCKET (1968-38B)
A. N. Winterbottom and D. G. King-Hele Aug. 1970 18 p refs
(RAE-TR-70137; UDC-521.6; UDC-521.312.4; UDC-531.112.2; UDC-551.510.53; UDC-629.19.077.3; UDC-629.195; BR-21439) Avail: NTIS

The orbit of Cosmos 219 rocket has been determined at 15 epochs with the aid of the orbit determination program PROP, using all available types of observation, visual, photographic and radar. The orbital elements obtained were generally of good accuracy. For 9 of the 15 runs, the values of eccentricity has standard deviations of 0.00003 or less, corresponding to s.d. of 200 m or less in perigee height, and the inclination had s.d. less than 0.004 deg, including one orbit with s.d. 0.0004 deg (1 1/2 sec of arc). A theoretical curve for the variation of inclination with time was fitted to the observed values to determine atmospheric rotational speed. Author (ESRO)

N72-14860# European Space Research and Technology Center, Noordwijk (Netherlands).
THERMAL ANALYSIS OF IN-FLIGHT PERFORMANCE OF THE ESRO 2 SATELLITE
G. Altmann and J. Doenecke Paris ESRO Jan. 1971 62 p refs
(ESRO-TN-29-ESTEC) Avail: NTIS

A study is made of the thermal behavior of the ESRO 2 spacecraft during the 15 months following launch (17 May 1968). It was found possible to make a meaningful analysis on the basis of data obtained from eleven selected orbits. Because the on-board tape recorder failed after about 6 1/2 months, the data for some of the orbits investigated are incomplete, real-time coverage being of the order of seven minutes per orbit. During the period concerned, the orbital conditions varied from full sunlight to 32% shadow, while perigee and apogee changed from 350 km to 331 km and from 1093 km to 937 km, respectively. A comparative analysis of the satellite thermal design in-flight performance is given. The in-flight temperature readings of 18 thermistors were compared with the temperatures calculated from a 36-node mathematical model incorporating the actual orbital conditions. Certain modifications to the mathematical model occasioned by this are discussed, and comments are made on the suitability of the thermistor locations. The thermal behaviour of the ESRO-2 satellite was as predicted before launch and, the satellite is still operating at normal temperatures.
Author (ESRO)

N72-14861# Naval Ordnance Lab., White Oak, Md.
AEROBALLISTIC EVALUATION AND COMPUTER STABILITY ANALYSIS OF THE US NAVY 20-MILLIMETER GENERAL PURPOSE PROJECTILE
Frank J. Regan and Virginia L. Schermerhorn 1 Jun. 1971 102 p refs
(Proj. NOL-483/NWC-005-31)
(AD-729238; NOLTR-71-95) Avail: NTIS CSCL 19/1

The report presents the results of ballistics range and wind-tunnel measurements of the static force and moment and the pitch-damping, roll-damping and magnus moments for a general purpose 20-millimeter projectile. Data are presented for a smooth and basic configuration. These aerodynamic data are used in a special digital computer program to rapidly assess the stability of the projectiles over various mission profiles. The normal-force and pitching-moment derivatives are evaluated, theoretically, by Wood's method and compared with the measurements. Author (GRA)

N72-14862# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
INFRARED ROCKET ASTRONOMY Semiannual Report, 11 Dec. 1970 - 10 May 1971
Martin O. Harwit, James R. Houck, Barrie W. Jones, Judith L. Pipher, and Baruch T. Soifer 10 May 1971 10 p ref
(Contract F19628-70-C-0128; ARPA Order 1366; AF Proj. 8692)
(AD-729456; AFCRL-71-0328; SAR-2; Rept-62301D) Avail: NTIS CSCL 17/5

The report describes the work completed between 11 December 1970 and 10 May 1971, and is divided into seven sections: performance of the reassembled telescope system, the new optical system, results of December 2, 1970 flight--short wavelength detectors, results of December 2, 1970 flight--long wavelength detectors, ground based effort, personnel, and publications. Author (GRA)

N72-14863# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
TRAJECTORY DATA FOR A SINGLE STAGE BALLISTIC MISSILE
V. J. Berinati and E. T. Williams Jul. 1971 135 p refs
(Contract DAHC15-67-C-0011)
(AD-729395; N-795; IDA/HQ-71-12648; Task-T-68) Avail: NTIS CSCL 16/2

The report presents numerical metric data on specific theoretical trajectories for a single-stage ballistic missile. Thirty-one trajectories are presented. Author (GRA)

N72-14864# Pan American World Airways, Inc., Patrick AFB, Fla. Aerospace Services Div.
VARIATIONS IN ORBITAL ELEMENTS
James A. Ward, Jr. Aug. 1971 84 p refs Prepared in cooperation with RCA Intern. Service Corp., Patrick AFB, Fla.
(F08606-68-C-0040)
(AD-729217; AFETR-TR-71-4) Avail: NTIS CSCL 22/3

Due to perturbative forces acting on a near earth satellite, the associated classical Keplerian orbital elements vary with time. These variations are divided into secular, short period and long period. The mathematical equations expressing these variations are presented without derivation along with numerical examples. A discussion of the practical applications of these variations to trajectory generation and orbit determination is included. Author (GRA)

N72-14865# RAND Corp., Santa Monica, Calif.
STABILITY AND CONTROL OF TRANSLUNAR EARTH ORBITS
R. H. Frick Jul. 1971 110 p refs
(Contract F44620-67-C-0045)
(AD-729758; R-668-PR) Avail: NTIS CSCL 22/3

In the report the author investigates the problem of keeping a satellite in an orbit around the earth at translunar distances from the earth. The study concentrates on distances between 300,000 and 500,000 n mi, as in this range the earth's gravitational attraction is the dominant factor in producing acceleration of a satellite vehicle relative to the earth. The approach to the problem involves formulation of the general nonlinear equations of motion for an object under the gravitational attraction of the earth, sun, and moon. The solution of these equations is in terms of the variation of the resulting motion from a nominal unperturbed circular orbit, and is obtained by numerical integration of the equations of motion. Although cases are found in which the radial variations from a reference orbital radius of 300,000 n mi remain less than 50,000 n mi for as long as 5 years, it appears to be desirable to have an orbital control capability. Author (GRA)

N72-14866# Aeronautical Chart and Information Center, St. Louis, Mo.
LUNAR GRAVITY ANOMALIES IN THE LIGHT OF GEOLOGICAL DATA
V. G. Trifonov Jun. 1971 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 196, no. 1, 1971 p 176-179
(AD-728301; ACIC-TC-1742) Avail: NTIS CSCL 03/2

The paper is a consideration of the significance of new data on the geology of the lunar surface. The surface layer of the moon consists mainly of alternating lenses or plates of crateral or extracrateral material; some of the extracrateral rock complexes are formations of lunar seas of different ages. Traces of extracrateral volcanism are preserved on the surface of the present seas, which gives a basis to assume that the marine material is magmatic. Author (GRA)

N72-14867# Ballistic Research Labs., Aberdeen Proving Ground, Md.
RESPONSE OF AN ASYMMETRIC MISSILE TO SPIN VARYING THROUGH RESONANCE
Charles H. Murphy Jul. 1971 33 p refs
(DA Proj. 1T2-62301-A-201)
(AD-729772; BRL-1545) Avail: NTIS CSCL 16/2

Asymptotic expansions of maximum response angle as well as resonance response angles are derived for constant spin acceleration and for spin acceleration to steady state spin. These show that the important parameter to be considered is the ratio of missile damping rate to the square root of spin acceleration at resonance. Predictions of the approximate theory are compared with exact numerical calculation for a variety of missiles and excellent agreement is seen for moderately damped missiles. Author (GRA)

N72-14868# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PARADOXES IN ASTRODYNAMICS
Peter Bielkowicz Aug. 1971 54 p refs
(AD-729781; AFIT-TR-71-3) Avail: NTIS CSCL 22/1

Several phenomena which take place in a low gravity field are investigated in the first two sections. The proper method for computation of a vertical jump on the Moon or any other planet is demonstrated. Trajectories of a ball launched from the surface of a spherical asteroid are determined and found to lead to some rather paradoxical results. The possibility of existence of dark bodies in the neighborhood of the solar system is examined and it is assumed that a neutron star is located at a distance of 1000 AU from the Sun. Possible orbits to such a star are investigated, and relativity effects are briefly outlined. Tidal effect on a vehicle and its crew is then examined. Tolerance criteria for the human body are introduced and a safe orbit is established. Author (GRA)

N72-14869# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE EXTENDED KALMAN FILTER APPLIED TO THE DETERMINATION OF THE ORBITAL PARAMETERS OF A PASSIVE EARTH SATELLITE M.S. Thesis
Charles E. Rogers Jun. 1971 74 p refs
(AD-730158; GE/EE/71S-1) Avail: NTIS CSCL 22/3

The extended Kalman filter is used to determine estimates of the orbital parameters, including drag, of a passive earth satellite. Actual tracking data from earth based radars were used and the orbital parameter estimates compared favorably with estimates obtained by other investigators using differential correction techniques. Also investigated was the utility of the extended Kalman filter for obtaining a sustained estimate of orbital parameters through several orbits with large data gaps and different radar site data for each orbit. The extended Kalman filter was not as effective under these circumstances, however, ad-hoc procedures were developed to sustain the estimate. Author (GRA)

N72-14426*# Minnesota Univ., Minneapolis.
THE ORIGIN AND GOALS OF THE AUTOMATED STELLAR PROPER MOTION SURVEY
Willem J. Luyten *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 1-3 (See N72-14425 05-14)
Avail: NTIS CSCL 03A

N72-14427*# Control Data Corp., Minneapolis, Minn.
THE AUTOMATION OF THE STELLAR PROPER MOTION SURVEY
James. S. Newcomb *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 3-14 refs (See N72-14425 05-14)
(Contract NSR-24-005-062)
Avail: NTIS CSCL 03A

N72-14442*# Hamburger Sternwarte (West Germany).
THE AGK3, A BASIS FOR A GENERAL (NORTHERN) REFERENCE CATALOGUE OF POSITIONS AND PROPER MOTIONS
Wilhelm Dieckvoss *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 161-168 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

N72-14443*# University of South Florida, Tampa.
AN ANALYSIS OF THE AGK3 COMPARISON STAR POSITIONS
Paul Herget (Cincinnati Obs.) *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 169-172 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

N72-14444*# Yale Univ. Observatory, New Haven, Conn.
RECENT PROGRESS ON THE YALE ZONE CATALOGUES
Dorrit Hoffleit *In* Univ. of South Fla. Conf. on Phot. Astrometric

Technique Nov. 1971 p 173-180 refs Sponsored by Army Map Service (See N72-14425 05-14)
Avail: NTIS CSCL 03A

N72-14445*# Naval Observatory, Washington, D.C.
COMPARISON OF THE SAO AND AGK3R „STAR CATALOGUES
F. P. Scott and C. A. Smith, Jr. *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 181-190 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

N72-14446*# University of South Florida, Tampa.
PLANS FOR A STANDARD REGION FOR LONG FOCUS ASTROGRAPHS
George D. Gatewood and Laurence W. Fredrick (Leander McCormick Obs.) *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 191-196 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

N72-14447*# Royal Observatory, Cape Town (South Africa).
CAPE PHOTOGRAPHIC CATALOGUES
R. H. Stoy *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 197-199 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

N72-14451*# University of South Florida, Tampa.
THE BEHAVIOR OF MAGNITUDE DEPENDENT SYSTEMATIC ERRORS
Heinrich Eichhorn *In its* Conf. on Phot. Astrometric Technique Nov. 1971 p 241-248 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

N72-14452*# DBA Systems, Inc., Melbourne, Fla.
INVERSION OF VERY LARGE MATRICES ENCOUNTERED IN LARGE SCALE PROBLEMS OF PHOTOGRAMMETRY AND PHOTOGRAPHIC ASTROMETRY
Duane C. Brown *In* Univ. of South Fla. Conf. on Phot. Astrometric Technique Nov. 1971 p 249-267 refs (See N72-14425 05-14)
Avail: NTIS CSCL 03A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also. 28 Propulsion Systems; and 32 Structural Mechanics.

N72-14870*# Little (Arthur D.), Inc., Cambridge, Mass.
APOLLO 14 COMPOSITE CASTING DEMONSTRATION Final Report
20 Aug. 1971 94 p refs
(Contract NAS8-26637)
(NASA-CR-61369) Avail: NTIS CSCL 22B

This program assisted in the design and implementation of the composite casting demonstration for the Apollo 14 mission. Both flight and control samples were evaluated. Some conclusions resulting from a comparison of the flight and control samples were: (1) Solidification in neither the flight nor control samples was truly directional. (2) Apparent intermittent contact of the melt with the container in the flight samples led to unusual nucleation and growth structures. (3) There was greater uniformity, on a macro scale, of both pores and structural features in the flight sample; presumably the result of the reduced gravity conditions. (4) It seems quite feasible to produce enhanced dispersions of gases and dense phases in a melt which is solidified in reduced gravity. (5) A two-stage heating/cooling cycle may help directional solidification. (6) Sample materials should be selected from materials in which the dispersant fully wets the matrix material. (7) Experiments should be conducted in two modes: (1) where the melt is in good thermal contact with the container, and (2) where the melt is in a free-float condition. Author

N72-14871*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
DEVELOPMENT OF AN ADHESIVELY BONDED BERYLLIUM PROPULSION STRUCTURE FOR THE MARINER MARS 1971 SPACECRAFT
James H. Stevens and William E. Layman 1 Jan. 1972 36 p
(Contract NAS7-100)
(NASA-CR-124742; JPL-TM-33-517) Avail: NTIS CSCL 22B

The design, testing, and fabrication of the support truss structure for the propulsion system of the Mariner 9 spacecraft are described. Support is provided by an 8.9-kg (19.5-lbm) truss assembly consisting of beryllium tubes adhesively bonded to magnesium end fittings. Beryllium was selected for the tubular struts in the truss because of its exceptionally high stiffness-to-weight ratio. Adhesive bonding, rather than riveting, was utilized to join the struts to the end fittings because of the low toughness (high notch sensitivity) of beryllium. Magnesium, used in the end fittings, resulted in a 50% weight saving over aluminum since geometric factors in the fitting design resulted in low stress areas where magnesium's lower density is a benefit. Author

N72-14872*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TEMPERATURE CONTROL OF THE MARINER MARS 1971 SPACECRAFT
1 Jan. 1972 42 p refs
(Contract NAS7-100)
(NASA-CR-124732; JPL-TM-33-515) Avail: NTIS CSCL 22B

The Mariner Mars 1971 orbiter mission was a part of the ongoing program of unmanned planetary exploration. The spacecraft design was based on that of Mariner Mars 1969, with changes as necessary to achieve mission objectives. The thermal design for Mariner Mars 1971 is described herein, with emphasis on those areas in which significant changes were implemented. Developmental tasks are summarized and discussed, and initial flight data are presented. Author

N72-14873*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION: SHUTTLE INTERFACE REQUIREMENTS
7 Dec. 1971 101 p
(Contract NAS9-9953)
(NASA-CR-115326; MSC-02474; MSC-T-575; SD-71-221) Avail: NTIS CSCL 22B

The interface requirements between the modular space station (MSS) and the space shuttle cover both the ground and orbital phases of operation from the launch of the first MSS module until the initial modular station has been manned and in routine operation. As a point of reference, the NR two-stage, fully reusable space shuttle, whose definition has been obtained from the space shuttle Phase B definition studies, has been selected around which the interface requirements have been described. Author

N72-14874*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC CHARACTERISTICS OF THE GRUMMAN H-33 ORBITER MATED TO A THREE SEGMENT SOLID PROPELLANT BOOSTER Wind Tunnel Test Data Report, 30 Aug. - 1 Sep. 1971
F. Sims (NASA. Marshall Spaceflight Center) and R. Olive

(NASA. Marshall Spaceflight Center) Dec. 1971 109 p
(Contract NAS8-4016)
(NASA-CR-120010; DMS-DR-1181; S-1042; DRL-184-58)
Avail: NTIS CSCL 22B

Experimental aerodynamic investigations were conducted on a .003366-scale model of the Grumman space shuttle configuration mounted to a three (3) segmented solid propellant booster. These tests were conducted in the MSFC 14-inch trisonic wind tunnel over a Mach number range of 0.6 to 4.96. The purpose of the test was to determine the aerodynamic characteristics of this configuration. Aerodynamic data was taken over a nominal angle of attack and angle of sideslip of -10 degrees to 10 degrees at zero degrees beta and alpha respectively. In addition, data was obtained for the H-33 orbiter alone to supplement data from TWT 502 and TWT 503. Author

N72-14875*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC CHARACTERISTICS OF THE MSFC PRESSURE FED BOOSTERS AT HIGH ANGLES OF ATTACK (M EQUALS 0.6 TO 5.0) Space Shuttle
John E. Baker Dec. 1971 242 p
(Contract NAS8-4016)
(NASA-CR-120026; DMS-DR-1208) Avail: NTIS CSCL 22B

Experimental aerodynamic investigations were conducted in the 14 x 14 inch trisonic wind tunnel during early December 1971 on 0.003366 scale models of the space shuttle pressure fed booster configurations. The basic configurations tested were a 40 deg cone/cylinder/13 deg flare designated the pressure fed booster and a 35 deg cone/cylinder designated the pressure fed booster configuration x. Six component aerodynamic force and moment data were recorded over a Mach number range from 0.6 to 5.0 at angles of attack from +20 to +60 deg at 0 deg sideslip and over a sideslip range from -10 to +10 deg at 31 and 52 deg angles of attack. Primary configuration variables for the two basic pressure fed booster configurations were fin size and fin dihedral position. Author

N72-14876*# Chrysler Corp., New Orleans, La.
DETERMINATION OF LONGITUDINAL AND LATERAL DIRECTIONAL AERODYNAMIC CHARACTERISTICS OF THE B19B PRESSURE-FED BOOSTER AND THE B19B BOOSTER/040A ORBITER LAUNCH CONFIGURATION
R. F. McGinnis and F. W. Eder Dec. 1971 589 p
(Contract NAS8-4016)
(NASA-CR-120022; DMS-DR-1204; S-0250; DRL-184-58)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The 0.003366 scale models of the space shuttle pressure-fed booster and booster/orbiter configurations were tested in the MSFC 14-inch trisonic wind tunnel. The test was conducted as a static stability and control investigation over a Mach range of 0.60 to 5.00. The booster alone configuration was tested with various tail sizes, tail wedge angles, tail flaps, spoilers, and a body flare drag skirt. Two launch configurations were tested; one being the MSC orbiter location on the booster tank and the other being the North American Rockwell orbiter location. Orbiter buildup, longitudinal position, incidence angle, and booster tail on and off were the variables for launch configuration. Booster alone models were pitched over an angle of attack range of -4 to +14 and +20 to +60 deg at zero deg yaw angle and yawed over an angle of sideslip range of -10 to +10 deg at 52 deg angle of attack. Launch configuration models were yawed -10 to +10 deg at zero degrees angle of attack and yawed -10 to +10 deg at zero and -6 deg angle of attack. All models were rolled 45 deg during selected runs. Author

N72-14877*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF SKYLAB EXPERIMENT T-013 CREW/VEHICLE DISTURBANCES
Bruce A. Conway, Charles T. Woolley, (appendix A), Peter R. Kurzhals, (appendix B), and Robert B. Reynolds, (appendix B) Washington Jan. 1972 67 p refs
(NASA-TN-D-6584; L-7985) Avail: NTIS CSCL 22A

A Skylab experiment to determine the characteristics and effects of crew-motion disturbances was developed. The experiment will correlate data from histories of specified astronaut body motions, the disturbance forces and torques produced by these motions, and the resultant spacecraft control system response to the disturbances. Primary application of crew-motion disturbance data will be to the sizing and design of future manned spacecraft control and stabilization systems. The development of the crew/vehicle disturbances experiment is described, and a mathematical model of human body motion which may be used for analysis of a variety of man-motion activities is derived. Author

N72-14878*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE STAGING SIMULATION
Charles E. Hall and Rex D. Agler (Northrop Corp., Huntsville, Ala.) 27 Dec. 1971 24 p
(NASA-TM-X-64631) Avail: NTIS CSCL 22B

The overall capability is described and delineated of a new digital computer program for simulation of space shuttle vehicle staging maneuvers. The important distinctive feature of the program is that it enables simulation of linkage-type separation devices (as well as all the more usual types) and includes the effects of interference aerodynamics and thrust impingement. A general flow description and a moderately detailed description of the major simulation components are presented. Some typical simulation results are shown, and the flexibility and growth potential of the basic simulation are discussed. Author

N72-14879*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE ESTIMATES FOR SPACE SHUTTLE VEHICLES USING A HYDROGEN OR A METHANE FUELED TURBORAMJET POWERED FIRST STAGE
Gerald Knip, Jr. and Joseph D. Eisenberg Washington Jan. 1972 33 p refs
(NASA-TN-D-6634; E-6367) Avail: NTIS CSCL 22B

Two- and three-stage (second stage expendable) shuttle vehicles, both having a hydrogen-fueled, turboramjet-powered first stage, are compared with a two-stage, VTOHL, all-rocket shuttle in terms of payload fraction, inert weight, development cost, operating cost, and total cost. All of the vehicles place 22,680 kilograms of payload into a 500-kilometer orbit. The upper stage(s) uses hydrogen-oxygen rockets. The effect on payload fraction and vehicle inert weight of methane and methane-FLOX as a fuel-propellant combination for the three-stage vehicle is indicated. Compared with a rocket first stage for a two-stage shuttle, an airbreathing first stage results in a higher payload fraction and a lower operating cost, but a higher total cost. The effect on cost of program size and first-stage flyback is indicated. The addition of an expendable rocket second stage (three-stage vehicle) improves the payload fraction but is unattractive economically. Author

N72-14880*# Scientific Translation Service, Santa Barbara, Calif.
RESIDUAL GAS INVESTIGATIONS DURING THE ESRO 1 SATELLITE TESTS
G. Saenger and W. Shickle Washington NASA Aug. 1971 24 p refs Transl. into ENGLISH from Raumfahrtforsch. (Stuttgart), vol. 1, 1971 p 1-8
(Contract NASw-2035)
(NASA-TT-F-13880) Avail: NTIS CSCL 22B

The two flight units of ESRO-1, named Aurorae and Boreas in orbit, were tested in space simulation chambers. During these tests, residual-gas measurements were made with the aid of a mass spectrometer. The outgassing rate of the spacecraft and the composition of the residual gas were studied as functions of test duration satellite attitude with respect to solar radiation. If the initial and final stages of such tests are ignored, the results show that the quantity of hydrocarbon gas derived from the

spacecraft is of the same order of magnitude as that derived from the oil used in the space-simulation chamber. Author

N72-14881*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DELTA-85 ORBITING SOLAR OBSERVATORY-H (OSO-H) OPERATIONS SUMMARY
20 Sep. 1971 42 p
(NASA-TM-X-67499; KSC-TR-1131) Avail: NTIS CSCL 22B

The objectives of the Orbiting Solar Observatory (OSO-H) are discussed. Subjects considered are the: (1) mission objectives, (2) mission plan, (3) post launch operations, (4) communications, and (5) test operations. Illustrations of the satellite configuration and the Delta 85 launch vehicle are included. Author

N72-14882*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ATLAS/CENTAUR-26 INTELSAT 4 (F3) OPERATIONS SUMMARY
7 Oct. 1971 36 p
(NASA-TM-X-67500; KSC-TR-1132) Avail: NTIS CSCL 22B

The design, development, and deployment of the Intelsat 4 satellite are discussed. Subjects considered are : (1) mission objective, (2) mission plan, (3) launch operations, (4) post launch operations, (5) communications equipment, and (6) test operations. Illustrations are provided to show the configuration of the satellite and launch vehicle and the operations intercommunication system network. Author

N72-14883*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE SMITHSONIAN EARTH PHYSICS SATELLITE (SEPS) DEFINITION STUDY, VOLUMES 1 THROUGH 4
Sep. 1971 307 p refs
(NASA-TM-X-64632; PD-MP-P) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

A limited Phase B study was undertaken to determine the merit and feasibility of launching a proposed earth physics satellite with Apollo-type hardware. The study revealed that it would be feasible to launch this satellite using a S-IB stage, a S-IVB with restart capability, an instrument unit, a SLA for the satellite shroud, and a nose cone (AS-204 configuration). A definition of the proposed satellite is provided, which is specifically designed to satisfy the fundamental requirement of providing an orbiting benchmark of maximum accuracy. The satellite is a completely passive, solid 3628-kg sphere of 38.1-cm radius and very high mass-to-area ratio (7980 kg sq mi). In the suggested orbit of 55 degrees inclination, 3720 km altitude, and low eccentricity, the orbital lifetime is extremely long, so many decades of operation can be expected. Author

N72-14884*# Ball Bros. Research Corp., Boulder, Colo.
MISSION DEFINITION STUDY FOR STANFORD RELATIVITY SATELLITE. VOLUME 1: SYSTEMS AND PROGRAM Final Report
22 Dec. 1971 476 p
(Contract NASw-2284)
(F71-07-Vol-1) Avail: NTIS CSCL 22B

The objective of the relativity satellite mission is to perform an experiment in which a gyroscope in motion about the earth undergoes precession, presumably relativistic, with respect to the fixed stars. Performance of this experiment would clearly test the general theory of relativity and its various modifications. This is the only experiment suggested to date which would confirm the existence of motional drift as well. A mission is defined in which the measurement of the geodetic effect term to 0.2 arc sec/yr is achievable and the measurement of both geodetic and motional drift terms to an accuracy of 0.001 arc sec/yr may be possible. The design of the flying dewar satellite needed to maintain the experiment at cryogenic temperatures is discussed. The gyroscopes, magnetometer, and optical contacting method for dimensional stability of the experimental assembly are considered. K.P.D.

N72-14885*# Ball Bros. Research Corp., Boulder, Colo.
MISSION DEFINITION STUDY FOR STANFORD RELATIVITY SATELLITE. VOLUME 2: ENGINEERING FLIGHT TEST PROGRAM Final Report
22 Dec. 1971 50 p
(Contract NASw-2284)
(F71-07-Vol-2) Avail: NTIS CSCL 22B

The need is examined for orbital flight tests of gyroscope, dewar, and other components, in order to reduce the technical and financial risk in performing the relativity experiment. A program is described that would generate engineering data to permit prediction of final performance. Two flight tests are recommended. The first flight would test a dewar smaller than that required for the final flight, but of size and form sufficient to allow extrapolation to the final design. The second flight would use the same dewar design to carry a set of three gryoscopes, which would be evaluated for spinup and drift characteristics for a period of a month or more. A proportional gas control system using boiloff helium gas from the dewar, and having the ability to prevent sloshing of liquid helium, would also be tested. Author

N72-14886*# Ball Bros. Research Corp., Boulder, Colo.
MISSION DEFINITION STUDY FOR STANFORD RELATIVITY SATELLITE. VOLUME 3: APPENDICES Final Report
22 Dec. 1971 141 p ref
(Contract NASw-2284)
(F71-07-Vol-3-App) Avail: NTIS CSCL 22B

An analysis is presented for the cost of the mission as a function of the following variables: amount of redundancy in the spacecraft, amount of care taken in building the spacecraft (functional and environmental tests, screening of components, quality control, etc), and the number of flights necessary to accomplish the mission. Thermal analysis and mathematical models for the experimental components are presented. The results of computer structural and stress analyses for support and cylinders are discussed. Reliability, quality control, and control system simulation by computer are also considered. K.P.D.

N72-14887*# National Aeronautics and Space Administration, Washington, D.C.
PLANNED DEVELOPMENT OF THE SPACE SHUTTLE VEHICLE
6 Jan. 1972 18 p
(NASA-News-Release-72-4) Avail: NTIS CSCL 22B

Information pertaining to the planned development of the space shuttle vehicle is presented. The package contains: (1) President's statement; (2) Dr. Fletcher's statement; (3) space shuttle fact sheet; (4) important reasons for the space shuttle. Author

N72-14888*# National Aeronautics and Space Administration, Washington, D.C.
THE PEOLE SATELLITE
Feb. 1971 47 p Transl. into ENGLISH of "Le Satellite Peole" Centre Natl. d'Etudes Spatiales, Bretigny, France, Dec. 1970 47 p
(NASA-TT-F-13852) Avail: NTIS CSCL 22B

The PEOLE satellite is described including payload, fairing, power supply, telemetry, command guidance, service modules and pyrotechnical system. Experiments to be carried out will concern stabilization by gravity gradient and the localization system. PEOLE (altitude 750-800 km, inclination 15 degrees) is the first satellite for geodetic purposes to be launched with less than 28 degree inclination. Laser telemetry and space geodesy are discussed. The network of 63 sites taking part on a worldwide basis in the program is described with equipment allocated. Author

N72-14889*# General Dynamics/Convair, San Diego, Calif.
DESIGN AND DEVELOPMENT OF PRESSURE AND REPRESSURIZATION PURGE SYSTEM FOR REUSABLE

SPACE SHUTTLE MULTILAYER INSULATION SYSTEM Quarterly Progress Report, 1 Jul. - 30 Sep. 1971
1 Dec. 1971 173 p refs
(Contract NAS8-27419)
(NASA-CR-121073; Rept-584-4-708; QR-1) Avail: NTIS CSCL 22B

Preliminary design and analysis of purge system concepts and purge subsystem approaches are defined and evaluated. Acceptable purge subsystem approaches were combined into four predesign layouts which are presented for comparison and evaluation. Two predesigns were selected for further detailed design and evaluation for eventual selection of the best design for a full scale test configuration. An operation plan is included as an appendix for reference to shuttle-oriented operational parameters. Author

N72-14890*# Scientific Translation Service, Santa Barbara, Calif.
EOLE BALLOONS PROJECT: DESCRIPTION OF THE DESTRUCTIVE EQUIPMENT
J. P. Bouloumie, (ed.) Washington NASA Feb. 1971 11 p refs Transl. into ENGLISH of "Project EOLE Ballons. Descriptif de l'Equipement Destructeur", Natl. Center for Space Studies, Mater. Mech. Dept., Bretigny, France, report
(Contract NASw-2035)
(NASA-TT-F-13866) Avail: NTIS CSCL 22B

The destruct devices used with the EOLE balloon program are discussed. Subjects considered are: (1) technical specifications, (2) acceptance criteria, (3) performance checks, (4) environmental tests, and (5) compatibility tests. Author

N72-14891*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
EXPERIMENT MODULE CONCEPTS STUDY. VOLUME 1: MANAGEMENT SUMMARY Final Report
Oct. 1970 72 p
(Contract NAS8-25051)
(NASA-CR-103069; GDC-DAA70-004-Vol-1) Avail: NTIS CSCL 22B

The minimum number of standardized (common) module concepts that will satisfy the experiment program for manned space stations at least cost is investigated. The module interfaces with other elements such as the space shuttle, ground stations, and the experiments themselves are defined. The total experiment module program resource and test requirements are also considered. The minimum number of common module concepts that will satisfy the program at least cost is found to be three, plus a propulsion slice and certain experiment-peculiar integration hardware. The experiment modules rely on the space station for operational, maintenance, and logistic support. They are compatible with both expendable and shuttle launch vehicles, and with servicing by shuttle, tug, or directly from the space station. A total experiment module program cost of approximately $2319M under the study assumptions is indicated. This total is made up of $838M for experiment module development and production, $806M for experiment equipment, and $675M for interface hardware, experiment integration, launch and flight operations, and program management and support. Author

N72-14892*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
EXPERIMENT MODULE CONCEPTS STUDY. VOLUME 2: EXPERIMENTS AND MISSION OPERATIONS Final Report
J. M. MacDonald Oct. 1970 188 p refs
(Contract NAS8-25051)
(NASA-CR-117655; GDC-DAA70-004-Vol-2) Avail: NTIS CSCL 22B

The baseline experiment program is concerned with future space experiments and cover the scientific disciplines of astronomy, space physics, space biology, biomedicine and biotechnology, earth applications, materials science, and advanced technology. The experiments within each discipline are grouped into functional program elements according to experiments that support a particular area of research or investigation and experiments that impose similar or related demand on space station support systems. The experiment requirements on module subsystems, experiment operating modes and time profiles, and the role of the astronaut are discussed. Launch and rendezvous with the space station, disposal, and on-orbit operations are delineated. The operational interfaces between module and other system elements are presented and include space station and logistic system interfaces. Preliminary launch and on-orbit environmental criteria and requirements are discussed, and experiment equipment weights by functional program elements are tabulated. N.E.N.

N72-14893*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
EXPERIMENT MODULE CONCEPTS STUDY. VOLUME 3: MODULE AND SUBSYSTEM DESIGN Final Report
J. R. Hunter and D. J. Chiarappa Oct. 1970 497 p refs
(Contract NAS8-25051)
(NASA-CR-117656; GDC-DAA70-004-Vol-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The final common module set exhibiting wide commonality is described. The set consists of three types of modules: one free flying module and two modules that operate attached to the space station. The common module designs provide for the experiment program as defined. The feasibility, economy, and practicality of these modules hinges on factors that do not affect the approach or results of the commonality process, but are important to the validity of the common module concepts. Implementation of the total experiment program requires thirteen common modules: five CM-1, five CM-3, and three CM-4 modules. A.L.

N72-14894*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
EXPERIMENT MODULE CONCEPTS STUDY. VOLUME 5 BOOK 1, APPENDIX A: SHUTTLE ONLY TASK Final Report
Oct. 1970 170 p
(Contract NAS8-25051)
(NASA-CR-117658; GDC-DAA70-004-Vol-5-Bk-1-App-A) Avail: NTIS CSCL 22B

Results of a preliminary investigation of the effect on the candidate experiment program implementation of experiment module operations in the absence of an orbiting space station and with the availability of the space shuttle orbiter vehicle only are presented. The fundamental hardware elements for shuttle-only operation of the program are: (1) integrated common experiment modules CM-1, CM-3, and CM-4, together with the propulsion slice; (2) support modules capable of supplying on-orbit crew life support, power, data management, and other services normally provided by a space station; (3) dormancy kits to enable normally attached modules to remain in orbit while shuttle returns to earth; and (4) shuttle orbiter. Preliminary cost estimates for 30 day on-orbit and 5 day on-orbit capabilities for a four year implementation period are $4.2 billion and $2.1 billion, respectively. A.L.

N72-14895*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
EXPERIMENT MODULE CONCEPTS STUDY. VOLUME 5, BOOK 2, APPENDIX B: COMMONALITY, APPENDIX C: MAINTAINABILITY Final Report
R. L. Bradley, H. Gottschalk, J. M. MacDonald, and J. N. Sharmahd Oct. 1970 329 p
(Contract NAS8-25051)
(NASA-CR-117659; GDC-DAA70-004-5-Bk-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Results are presented of commonality analysis used to evaluate potential commonality among module design concepts developed to meet the individual needs of candidate experiment groups and of reliability, Maintainability, and safety analyses used to develop design guidelines for experiment modules which

will minimize the cost of sustaining experiment operations. These investigations were conducted to identify and validate the set of modules which provided the lowest cost total experiment program. A.L.

N72-14896*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CREW/CARGO AND LOGISTICS MODULE DEFINITION
Nov. 1971 200 p
(Contract NAS8-25140)
(NASA-CR-121079; MDC-G2683; MSFC-DPD-235/DR-SE-06) Avail: NTIS CSCL 22B

The logistics requirements for the space station cargo, the initial buildup, and the 90 day resupply are presented, along with the conceptual selection for the orbiter crew accommodations and the GSS logistics system. Various module configurations are outlined; structural/mechanical, environmental, temperature, voice communication, and data bus subsystems are also reviewed. Ground operations and module prelaunch and launch operations are discussed, as well as logistics system interfaces for space shuttles and stations. J.A.M.

N72-14897# Royal Aircraft Establishment, Farnborough (England).
LUMPED GEOPOTENTIAL COEFFICIENTS C SUB 15,15 AND S SUB 15,15 OBTAINED FROM RESONANT VARIATION IN THE ORBIT OF ARIEL 3
R. H. Gooding Apr. 1971 37 p refs
(RAE-TR-71068) Avail: NTIS

The orbital inclination of the satellite Ariel 3 unexpectedly decreased early in 1968. Due to a 15th-order resonance with the earth's gravitational field. Analysis of the resonance leads to a derivation of lumped values of the harmonic coefficients appropriate to the inclination (80 deg) and height (500 km) of Ariel 3. The steady residual decrease in inclination indicates that the average rotational speed of the upper atmosphere at a height of 500 km is only 0.7 times that of the earth. Author (ESRO)

N72-14898# Royal Aircraft Establishment, Farnborough (England).
POWER DECAY CHARACTERISTICS FOR A SOLAR-ELECTRICALLY PROPELLED SPACECRAFT DURING ORBIT EXPANSION TO SYNCHRONOUS HEIGHT
N. E. Ives Apr. 1971 59 p refs
(RAE-TR-71075) Avail: NTIS

Orbital transfer characteristics in terms of power and transfer time are described. Power profiles are generated to enable ion thrusters and power conditioning equipment to be arranged and programmed to provide a matched load at all times to the varying power output of the array. Information is presented which enables the selection of a parking orbit and ion thruster system exhaust velocity which satisfies specified requirements. Transfer time and payload best matched in terms of power and equipment mass for the transmission of direct-to-home are television following transfer to geostationary orbit. It is found that a single curve can be drawn as a guide to the percentage power loss versus transfer time to geostationary orbit from all 5 deg inclined parking orbits for all propulsion system exhaust velocities in the range 20 to 60 km/s.
Author (ESRO)

N72-14899# Royal Aircraft Establishment, Farnborough (England).
DESIGN FOR HIGH PRECISION IN SPACECRAFT JET ATTITUDE CONTROL SYSTEMS
W. G. Hughes Apr. 1971 127 p refs
(RAE-TR-71089; UDC-629.19.031.32:629.19.014.6) Avail: NTIS

A class of systems is proposed in which an electronic model of an idealized jet attitude control system is carried in the spacecraft. Jet commands in the model also command real jets. The modelled variables are applied to the sensor outputs by followup servos whose speeds of response can be adjusted to seek the compromise between the conflicting aims of low sensitivities to sensor noise and disturbing torque. The quality of the rate information available in the model may be sufficient to widen the scope for selection of jet switching logic, permitting a significant reduction in dead-band width by comparison with earlier systems. The procedures were validated by construction of onboard electronics for a sample system, followed by testing in association with analog simulation. ESRO

N72-14900# Virginia Commonwealth Univ., Richmond. Dept. of Biometry.
MISSILE SYSTEM PERFORMANCE PARAMETER OPTIMIZATION MODEL
Raymond H. Myers Redstone Arsenal, Ala. Army Missile Command Apr. 1971 69 p refs
(Contract DAAH01-71-C-0026)
(AD-728850; DA-TR-71-8) Avail: NTIS CSCL 16/4

The purpose of this report is to develop the theory associated with a Missile System Performance Parameter Optimization Model. A dual response surface system is assumed and the theoretical framework is developed for arriving at optimum conditions on a set of independent variables. The approach is to find conditions which maximize a 'primary response' subject to the constraint that a 'secondary response' takes on some specified or desirable value. An algorithm is outlined whereby a user can generate simple two dimensional plots to determine the conditions of constrained maximum primary response subject to the secondary response taking on any value he wishes. He, thus, is able to reduce to simple plotting the complex task of exploring the dual response system. In certain situations it becomes necessary to apply a double constraint, the second being that the located operating conditions be a certain 'distance' from the origin of the independent variables, (or the center of the experimental design). The procedure applies to optimizing in cases where it is desirable to employ two measures of effectiveness, cost often being the prime candidate for the secondary response and a single measure of performance as the primary response. Author (GRA)

N72-14901# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A CLASSICAL DESIGN APPROACH TO A NORMAL ACCELERATION STABILITY AUGMENTATION SYSTEM FOR A HIGH PERFORMANCE AEROSPACE VEHICLE M.S. Thesis
Ralph R. Ward, Jr. Jun. 1971 105 p refs
(AD-730152; GGC/EE/71-25) Avail: NTIS CSCL 01/3

The thesis represents a response to the design challenge problem presented at the 1970 Joint Automatic Control Conference. The design entailed a stability augmentation system for a high speed, high performance aerospace vehicle, including consideration of the first two structure modes. A normal acceleration system with a pitch rate inner loop was designed. Root locus techniques were used exclusively in obtaining an appropriate filter and fixed compensation in the pitch rate and normal acceleration loops. Relatively simple, but not large, gain changes in both loops were necessary to achieve the desired time responses to a commanded input. Realistic gust responses proved to be well within prescribed tolerances. Author (GRA)

N72-14902# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PRELIMINARY DESIGN OF AN ENERGY MANAGEMENT CONTROL SYSTEM FOR A HIGH PERFORMANCE LIFTING BODY REENTRY VEHICLE M.S. Thesis
John W. Bunnell Jun. 1971 97 p refs
(AD-730155; GGC/EE/71-3) Avail: NTIS CSCL 22/2

A preliminary design was developed for the guidance and phugoid damping portions of an energy management system to be used aboard a lifting body with a hypersonic L/D near 3.0, during the atmospheric maneuvering phase of reentry. A three-degree-of-freedom simulation was derived, using range

angle, cross-range angle and radius as state variables. The guidance scheme considered was based on a fast-time prediction of the footprint and nominal trajectory by numerical integration of the equations of motion. Temperature constraints, maximum heating rates and structural limits were neglected. Author (GRA)

N72-14903# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF THE FDL-8 LIFTING BODY LATERAL-DIRECTIONAL MODES AND PRELIMINARY DESIGN OF A STABILITY AUGMENTATION SYSTEM FOR SUBSONIC FLIGHT M.S. Thesis
Gat M. Chin Jun. 1971 151 p refs
(AD-730150; GGC/EE/71-4) Avail: NTIS CSCL 22/2

The problem was to determine if the FDL-8 manned re-entry vehicle lateral-directional modes have clearly adequate pilot handling qualities in subsonic flight. If not, a SAS was to be designed. Lateral characteristics for 21 subsonic flight conditions were obtained from linearized aircraft lateral equations. Assumptions were that symmetrical reference flight conditions and small-perturbation theory apply. The characteristics compared with requirements for highest level handling qualities showed a SAS was required. A two-loop SAS was designed using root-locus techniques. The yaw damper loops included undesirable roll-spiral coupling but the roll damper, second loop suppressed the roll-spiral coupling. Author (GRA)

N72-14904# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIRING ANTIAIRCRAFT MISSILES
F. K. Neupokoev 28 Jun. 1971 390 p refs Transl. into ENGLISH of the publ. "Strel'ba Zenitnymi Raketami" Moscow, Izd-vo Min. Oborony SSSR, 1970 p 1-354
(FTD Proj. 314007829; FTD Proj. 314007809; FTD Proj. 117017862)
(AD-730370; FTD-MT-24-05-71; DIA-Task-T65-04-18A) Avail: NTIS HC $6.00/MF $0.95 CSCL 16/4

In the book an account is given in a form which is accessible for a wide circle of readers, of questions pertaining to the theory of guidance and firing of antiaircraft guided missiles. The book is written on the basis of materials published in the open press. The examples given are constructed on arbitrary data and bear an illustrative nature. In the book an analysis and evaluation are made of the methods of guidance of remote-controlled and homing missiles. The questions of the dynamics of flight and control of antiaircraft missiles in conformance to the assignments of the bases of firing are stated. The characteristics of errors in the guidance of a missile are given and the factors which determine the coordinate law for hitting a target are considered. The methods of evaluation of the effectiveness of firing antiaircraft guided missiles are considered. In conclusion the concept is given about the determination of the limits of the zone of destruction and fire capacity of an antiaircraft missile complex. In presenting the material, considerable attention is allotted to the expansion of the physical meaning of the phenomena, which accompany the firing of antiaircraft guided missiles, and the influence of firing conditions on its effectiveness. Author (GRA)

N72-14346# Joint Publications Research Service, Washington, D.C.
PROBLEMS AND ORGANIZATION OF SUN-ATMOSPHERE EXPERIMENT
V. P. Teslenko and A. A. Fokin *In its* Invest. of the Atmosphere and Ionosphere during Period of Increased Solar Activity 16 Dec. 1971 p 16-26 refs (See N72-14344 05-13)
(UDC-551.510.535:551.508) Avail: NTIS

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-14905# Indian Inst. of Tech., Kanpur. Dept. of Aeronautical Engineering.
CREEP UNDER COMPLEX VARYING STRESS SYSTEMS
N. G. R. Iyengar and P. N. Murthy 1971 15 p refs
(AE-13/1971) Avail: NTIS

The possibility of applying the constant stress law to varying multiaxial stress states is examined. Two simple methods of superposition were used. The theoretical results are compared with the experimental data. In both the cases the maximum errors are of the order of + or - 30 percent. The theory is also applied to predict deformation at any specified time for a thick-walled cylinder under varying internal pressures. The agreement between the theory and the available experimental data seems to be good. Author

N72-14906# Lockheed Missiles and Space Co., Palo Alto, Calif.
ALGORITHM OF THE METHOD OF CHARACTERISTICS FOR THE ANALYSIS OF NONLINEAR ONE-DIMENSIONAL WAVE PROCESSES OF CONICAL AND CYLINDRICAL SHELL DEFORMATION
A. Ia. Lakhe and U. K. Nigul [1971] 16 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 35, no. 4, 1971 p 690-700
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An algorithm is proposed for realizing the method of characteristics for the analysis of one-dimensional wave processes excited by the edge effect and described by a quasi-linear system of differential equations having several pairs of families of characteristics. The algorithm is written in Lagrangean coordinates for conical and cylindrical shells, on the basis of a quasi-linear system of sixth order equations of a geometrically nonlinear theory of Timoshenko type. The algorithm presumes the absence of strong discontinuities, i.e. in the first derivatives of the shell displacement, which limits the class of admissible edge effects and permits carrying out the analysis up to the appearance of the first shock in problems where the shocks originate during wave propagation. The proposed algorithm also permits elucidation of specific properties of the wave solution in nonlinear theory. An illustrative example is given for a conical shell. Author

N72-14907*# Alabama Univ., Huntsville. Research Inst.
PHENOMENA AFTER METEOROID PENETRATION OF A BUMPER PLATE Quarterly Report
F. C. Todd 31 Jul. 1971 211 p refs
(Contract NAS8-26773)
(NASA-CR-121069; QR-2) Avail: NTIS CSCL 13M

The analysis of hypervelocity impact of particles on a detector in space, with flow and shock penetration through fluid, plastic, and elastic zones was studied. The original paper and computer program on this topic is presented. Improvements in the program for the study of the formation of a cone of debris are discussed. The truncated apex of the cone is at the hole formed by the penetration of an initially spherical rock through a thin plate. A solution for the penetration of the thin plate was sought. K.P.D.

N72-14908# California Univ., Berkeley. Dept. of Civil Engineering.
DYNAMIC PROGRAMMING AND A MAX-MIN PROBLEM IN THE THEORY OF STRUCTURES

Nestor Distefano Sep. 1971 24 p refs
(Grant GM-16197-03)
(TR-71-35) Avail: NTIS

A max-min problem in the field of optimum structural beam design was formulated and investigated from a dynamic programming point of view. It is shown that the conditions of optimality can be directly derived from the Hamilton-Jacobi-Bellman equation of the process. The classical Euler-Lagrange equations for the beam are derived from the fundamental partial differential equation. It is shown that the conditions of optimality associated with the minimum operation are local expressions of the theorem of Castigliano. An analytical solution for the unconstrained optimum cantilever lying on an elastic foundation is given, and a method of successive approximations consisting of a stable, two-sweep iterative procedure, is developed. Numerical examples are presented. Author

N72-14909# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE SCATTER FACTORS FOR LIVES WITH KNOWN VARIANCES
D. G. Ford Jun. 1971 8 p refs
(ARL/SM-368) Avail: NTIS

Expected values are calculated for the associated percentiles and risks of failure together with confidence regions. A means of finding the variance of the estimated risk is indicated. Author

N72-14910# Royal Aircraft Establishment, Farnborough (England).
THE RELATIONSHIP BETWEEN STRESS AND STRAIN IN TENSILE TESTING OF HETEROGENEOUS ALLOYS
W. Truszkowski Sep. 1971 14 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 53, no. 9, 1962 p 601-604
(RAE-LIB-TRANS-1584) Avail: NTIS

It is shown that the equation given by Krupkowski is suitable for the analysis of tensile tests. This relationship was examined for some heterogeneous metals and alloys. The degree of heterogeneity of the material can be calculated by means of suitably defined coefficients of uniform elongation. This assumption was tested on copper, Monel alloy, and steel; the coefficient s is proposed as a measure of the degree of heterogeneity. Theoretical considerations and experimental results lead to the conclusion that it should also be possible to calculate the value of this coefficient from ball hardness measurements. Author

N72-14911# Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
TRAVELLING WAVE TYPE FLUTTER OF FLAT PANELS IN INVISCID FLOW. PART 1: INFINITE PANELS
Aleksander Kornecki Sep. 1971 172 p refs Sponsored in part by Gerard Swope Found.
(Proj. 150094)
(Publ-132) Avail: NTIS

An analysis of the traveling wave type flutter of flat panels in inviscid flow is presented. The limitations of different approaches are explained and the experimental results are reviewed. The condition of panels of infinite length in the streamwise direction is investigated. The traveling wave type character of flutter of finite panels is emphasized and compared with the standing wave type flutter. The flow velocities considered extend from incompressible to high supersonic. Author

N72-14912# Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
TRAVELLING WAVE TYPE FLUTTER OF FLAT PANELS IN INVISCID FLOW PART 2: PANELS OF FINITE LENGTH
Aleksander Kornecki Oct. 1971 99 p refs Sponsored in part by Gerard Swope Found.
(Publ-133) Avail: NTIS

An analysis of the vibrations of finite panels in moving air is presented. It is shown that the vibrations are the traveling wave type and the model shapes differ completely from those in vacuum or air at rest. The results obtained with infinite panels are compared with those for finite panels. The panels used were unstretched rectangular panels, simply supported along all edges. Author

N72-14913*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FUNDAMENTAL MECHANISMS OF TENSILE FRACTURE IN ALUMINUM SHEET UNIDIRECTIONALLY REINFORCED WITH BORON FILAMENT Ph.D. Thesis - Virginia Polytechnic Inst.
Harvey Wayne Herring Dec. 1971 146 p refs
(NASA-TM-X-67577) Avail: NTIS CSCL 20K

Results are presented from an experimental research effort to gain a more complete understanding of the physics of tensile fracture in unidirectionally reinforced B-Al composite sheet. By varying the degree of filament degradation resulting from fabrication, composite specimens were produced which failed in tension by the cumulative mode, the noncumulative mode, or by any desired combination of the two modes. Radiographic and acoustic emission techniques were combined to identify and physically describe a previously unrecognized fundamental fracture mechanism which was responsible for the noncumulative mode. The tensile strength of the composite was found to be severely limited by the noncumulative mechanism which involved the initiation and sustenance of a chain reaction of filament fractures at a relatively low stress level followed by ductile fracture of the matrix. The minimum average filament stress required for initiation of the fracture mechanism was shown to be approximately 170 ksi, and appeared to be independent of filament diameter, number of filament layers, and the identity of the matrix alloy. Author

N72-14914# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
THE EFFECTS OF INTERLAMINAR SHEAR ON THE BENDING AND BUCKLING OF FIBER REINFORCED, COMPOSITE, FLAT AND CURVED PLATES Final Report
Harold Durlofsky and Jean Mayers May 1971 86 p refs
(Contract DAAJ02-70-C-0075; DA Proj. 1F0-61102-A-33-F)
(AD-728834; USAAVLABS-TR-71-10) Avail: NTIS
CSCL 11/4

A small deflection plate theory is developed which includes higher order approximations to the effects of transverse shear. The governing equations and associated boundary conditions are developed by a variational method. The theory is sufficiently general to encompass anisotropic, laminated, composite, circularly curved, cylindrical plate elements of nonsymmetric cross section. Specific applications are made to the bending and the axial compression buckling of simply supported flat plates and to the axial compression buckling of curved plates and shells having classical, simple supports. It is shown that the effects of interlaminar shear can be significant in composite constructions which use very high strength fiber reinforcement. Author (GRA)

N72-14915# Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
WAVES IN NONLINEAR RATE DEPENDENT MATERIALS Ph.D. Thesis
Dwight T. Davy Aug. 1971 115 p refs
(Contract DAAF03-69-C-0014)
(AD-729370; THEMIS-UI-36) Avail: NTIS CSCL 20/12

A one-dimensional problem in dynamic viscoelasticity is formulated using a nonlinear constitutive law which admits wave propagation at constant speed. General similarity solutions are developed for the problem and their applicability to boundary value problems is discussed. An approximate solution is developed for an initial value problem based on a special case of the constitutive equation. The solution uses a two-time-variable regular perturbation technique. Author (GRA)

N72-14916# Brown Univ., Providence, R.I.
THE ELASTIC STABILITY OF TWO-PARAMETER NONCONSERVATIVE SYSTEMS
K. Huseyin and R. H. Plaut Aug. 1971 25 p refs
(Contract N00014-67-A-0191-0009; NR Proj. 041-111; RR Proj. 003-01-01)
(AD-729401) Avail: NTIS CSCL 20/11

The stability of a linear, elastic, circulatory system with two independent loading parameters is studied in general terms. The basic properties of the stability boundary are investigated and several theorems are established. It is shown that for a two-degree-of-freedom system which is capable of flutter instability, the stability boundary is always convex toward the region of stability, in direct contrast with systems which cannot exhibit flutter. The practical significance of this result in obtaining lower and upper bound estimates of the stability boundary is emphasized, and three illustrative examples are presented.
Author

N72-14917# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EFFECTIVE STIFFNESS THEORY FOR ELASTIC WAVE PROPAGATION IN FILAMENTARY COMPOSITE MATERIALS Ph.D. Thesis
Rodney A. Bartholomew Jun. 1971 256 p refs
(AD-729776; DS/MC/71-1) Avail: NTIS CSCL 11/4

An approximate first order theory for elastic wave propagation in composite materials composed of long fibers of rectangular cross section embedded in a soft matrix is developed. Included are stress and displacement equations of motion, boundary conditions, and constitutive relations. Higher order stresses are related to average conventional stresses and moments of stresses. The boundary conditions are shown to be averaged forms of Cauchy's law of classical elasticity. Procedures for reducing the theory to that of classical elasticity and that for laminates are established. In addition, displacement equations of motion for a limited second order theory for flexural motion are presented. For propagation parallel to the fiber orientation in an unbounded medium, the motion separates into three distinct types: longitudinal, flexural, and torsional. All motions are dispersive and are sensitive to changes in relative material stiffnesses and geometry. For propagation perpendicular to the fiber orientation, the motion is dispersive and frequency spectra show stopping bands typical of periodic media. Author (GRA)

N72-14918# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NATURAL FREQUENCIES OF MEMBRANES AND PLATES WITH SLIGHTLY NONCIRCULAR BOUNDARIES M.S. Thesis
Darrel L. Nesseth Jun. 1971 117 p refs
(AD-729778; GA/MC/71-7) Avail: NTIS CSCL 20/11

A theoretical study was made to determine whether or not the first natural frequencies of noncircular membranes and plates could be obtained using regular perturbation theory. The boundary equation of the noncircular membrane or plate is given by a chosen circular radius plus a term which represents the deviation of the noncircular boundary from a circle. The mode shape of free vibration for the noncircular membrane or plate is assumed to be represented by an asymptotic series which contains the mode shape for a circular membrane or plate plus additional terms of decreasing magnitude. Boundary conditions are imposed on the resulting expressions and through Taylor series expansions about the circular radius, a characteristic equation for frequency is obtained for the noncircular membrane or plate. The correspondence between the term of the boundary expression giving the noncircularity of the membrane or plate and any general shape varying from circular was established. Specific values of the term are given for an ellipse and a square.
Author (GRA)

N72-14919# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
ELASTIC WAVES PRODUCED BY LONGITUDINAL IMPACT ON A SYSTEM WITH SYMMETRICALLY BRANCHED RODS
James D. Lee May 1971 27 p refs
(Grant DA-ARO(D)-31-124-71-G95)
(AD-729822; AROD-5606-14-E; TR-17) Avail: NTIS CSCL 20/11

The problem of the propagation of a longitudinal elastic wave which is travelling along a thin uniform rod at the end of which a branched, symmetrically arranged system of rods is joined is treated analytically. The symmetry condition greatly simplifies the analysis and enables the problem to be treated as a two-dimensional one. The theory used for the propagation of longitudinal waves along the rods is the simple one-dimensional one while flexural wave propagation is treated by the Timoshenko theory. The numerical results obtained with this analysis are found to agree well with experimental observations.
Author (GRA)

N72-14920# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOVEMENT OF A CYLINDRICAL SHELL DUE TO AN ACOUSTIC SHOCK WAVE
A. G. Gorshkov, E. I. Grigoluk, A. V. Kromushkin, and F. N. Shklyarchuk 12 Jul. 1971 16 p refs Transl. into ENGLISH from Mekh. Tverd. Tela (Moscow), no 4, 1969 p 85-90
(AD-730039; FTD-HC-23-321-71) Avail: NTIS CSCL 20/11

An investigation is made of the behavior of a thin elastic, flat, cylindrical shell of finite size fastened to a rigid cylindrical screen, under the influence of a plane acoustic shock wave whose front is parallel to the generatrix of the shell. The hydrodynamic pressure, acting on the surface of the shell, can be found using previous studies. The nonlinear equations of motion of the shell that make an allowance for the inertia in the radial, circumferential, and longitudinal directions, are integrated using the finite-difference method. Data are given concerning the reaction of the shell for three types of boundary conditions, and a comparison is made with previous results. Author (GRA)

N72-14921# Watervliet Arsenal, N.Y.
WAVE PROPAGATION IN AN INFINITE CANTILEVER PLATE STRIP
Wayne W. Walter Apr. 1971 19 p refs
(DA Proj. 1F0-61102-A-33-F)
(AD-729796; WVT-7121) Avail: NTIS CSCL 20/11

The dispersion of straight-crested waves propagating down an infinite cantilever plate strip is investigated by means of Mindlin's theory of flexure. Author (GRA)

N72-14922# Watervliet Arsenal, N.Y.
EFFECTIVE STIFFNESS AND EFFECTIVE MODULUS SIMPLE THICKNESS MODES FOR LAMINATED MEDIA
Charles R. Thomas Aug. 1971 79 p refs
(DA Proj. 1F0-61102-A-35-D)
(AD-729795; WVT-7138) Avail: NTIS CSCL 20/11

The simple thickness modes for laminated media with layering both parallel and perpendicular to the plate free surfaces are studied according to the Effective Stiffness theory and the results obtained are compared to results found from the Effective Modulus theory. Results are presented in a number of graphs depicting the variation of dimensionless frequency with changes in dimensionless thickness ratio. Author (GRA)

N72-14923# Army Materials and Mechanics Research Center, Watertown, Mass.
ANALYSIS OF CRACKS IN WIDE ORTHOTROPIC PLATE WITH LONGITUDINAL STIFFENERS
Chatta Lakshmikantham Aug. 1971 19 p refs
(DA Proj. 1T0-62105-A-349)
(AD-729801; AMMRC-TR-71-29; AMCMS-Code-502E.11.299; DA-0C4693) Avail: NTIS CSCL 20/11

Recently, the Howland-Isida approach to cracks in isotropic strips was extended by Lakshmikantham to the case of an orthotropic strip with edge stiffeners. The present report uses his

techniques in solving the problem of a tensioned wide plate with parallel stringers and stress free cracks in alternate panels. The results of this problem together with the previous study are expected to cover many cases of aircraft structural importance; especially where fiber-reinforced composites are used.

Author (GRA)

N72-14924# Boeing Co., Kent, Wash. Aerospace Group.
A TEST TECHNIQUE TO STUDY INTERLAMINAR SHEAR PHENOMENA OF LAMINATED COMPOSITES Final Report, Jul. 1970 - Jun. 1971
Ronald F. Zabora and James E. Bell Wright-Patterson AFB, Ohio AFFDL Jul. 1971 85 p refs
(Contract F33615-70-C-1292; AF Proj. 4364)
(AD-729872; AFFDL-TR-71-67) Avail: NTIS CSCL 14/2

The objective of the program was to develop a test method and a configuration for the determination of the interlaminar strength of fibrous composites. The slip plane shear interlaminar test technique was selected over several existing test methods as the most promising technique to measure and characterize the interlaminar shear strength of laminated composites. The test method was utilized to evaluate four basic laminates and a quasi-isotropic laminate made of boron/NARMCO 5505 prepreg. The basic laminates evaluated were 0, 90, 0/90, and plus or minus 45 degrees. The interlaminar shear strength of the plus or minus 45 degrees laminate was one-third less than that of the 0 degrees laminate. This apparent decrease in strength is believed due to residual stresses resulting from the lamination process and fiber orientation effects. Evaluation of data on quasi-isotropic laminate indicated that the interlaminar strength of a combination laminate could not be directly predicted from the basic laminate data.

Author (GRA)

N72-14925# Dayton Univ. Research Inst., Ohio.
THE AFML TORSIONAL SPLIT HOPKINSON BAR Technical Report, Sep. 1969 - Apr. 1971
Theodore Nicholas, John E. Lawson, and Ira Fiscus Wright-Patterson AFB, Ohio AFML Jul. 1971 38 p refs
(Contract F33615-69-C-0045)
(AD-729880; AFML-TR-71-145; Task-735106) Avail: NTIS CSCL 20/11

The development, construction, and use of an experimental apparatus for testing materials in torsion at high rates of strain is described. Constant strain rate data can be obtained at shear strain rates from 100 to 10,000/sec. The operation, calibration, and instrumentation of a torsional split Hopkinson bar apparatus is presented along with a discussion of the accuracy and reliability of data obtained with this device. Experimental data on commercially pure 1100-0 aluminum at high strain rates are obtained and compared with quasi-static data and those of other investigators.

Author (GRA)

N72-14926# Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
SCATTERING AND RADIATION OF GRAVITY WAVES BY AN ELLIPTICAL CYLINDER M.S. Thesis Final Report, 1970-1971
Hsuan S. Chen and Chiang C. Mei Aug. 1971 153 p refs
(Contract N00014-67-A-0204-0036; MIT Proj. DSR-71972)
(AD-729728; Rept-140; R71-29) Avail: NTIS CSCL 13/13

Theoretical results of scattering and radiation of simple-harmonic gravity waves by a vertical cylinder of elliptical cross-section are worked out. The cylinder extends from the free surface to the bottom of the sea of constant depth. Linearized theory for small amplitude waves is adopted. The question of flow separation is not treated. The mathematical solution leads to Mathieu's equations and the computer program by Clemm is used. Physical quantities calculated include the wave forces and moments in various directions on, and the scattering amplitude around, a stationary cylinder due to a plane incident wavetrain. Also calculated are the damping coefficients representing radiation energy losses due to various modes of oscillation of a cylinder in the absence of incident waves. By the method of images the scattering of plane incident wave by a semi-elliptical peninsula is studied. Extensive numerical results are presented for various degrees of ellipticity, angles of incidence, and for wave-lengths ranging from very long to ones comparable to the horizontal dimensions of the cylinder. These results should provide useful information for the design of large ocean structures.

Author (GRA)

N72-14927# Pennsylvania State Univ., University Park. Ordnance Research Lab.
TRANSVERSE VIBRATION OF NONUNIFORM, INTERNALLY DAMPED CANTILEVER BEAMS
R. L. Kerlin 11 May 1971 34 p refs
(Contract N00017-70-C-1407)
(AD-729700; TM-71-70) Avail: NTIS CSCL 13/10

The Bernoulli-Euler theory of transverse beam vibration, suitably extended to take into account internal damping, is used to derive general expressions in closed-form for the driving-point impedance and force transmissibility of each of three types of nonuniform cantilever beams: a truncated beam of rectangular section with constant breadth and a depth of increasing or decreasing linear taper, a truncated beam of rectangular section with a depth of increasing or decreasing linear taper and a breadth appropriately varied (hyperbolically) to maintain constant cross-sectional area, and a beam composed of three stages, each of which is uniform but varies arbitrarily from the others in cross section and length. In each case, the beam is driven at its free end by a sinusoidally varying point force, and the frequency dependence of its impedance and transmissibility has been calculated. Representative results are presented for beams having the same length and mass and are compared with the response of an equally long and massive uniform beam.

Author (GRA)

N72-14928# Army Materials and Mechanics Research Center, Watertown, Mass.
ANALYSIS OF AN INCLINED CRACK CENTRALLY PLACED IN AN ORTHOTROPIC RECTANGULAR PLATE
Kanu R. Gandhi Aug. 1971 26 p refs
(DA Proj. 1T0-61102-B-32-A)
(AD-730911; AMMRC-TR-71-31) Avail: NTIS CSCL 13/13

The problem of an inclined crack centrally placed in a generally orthotropic rectangular plate under tension is investigated. The modified mapping-collocation technique introduced by Bowie et al. is used in the analysis and the stress intensity factors are computed for several orientations of cracks and for rectangles of various proportions. The effects of orientation of the principal axes of orthotropy are also considered. The results indicate a fairly strong dependence of the stress field on the orientation of this principal axes of the material and the occasional complexity of the interaction of material anisotropy and the geometry of the specimen.

Author (GRA)

N72-14929# Watervliet Arsenal, N.Y. Benet R and E Labs.
CHORDWISE BENDING DEFORMATIONS OF RECTANGULAR PLATES
Wayne W. Walter and Gary L. Anderson Jun. 1971 128 p refs
(DA Proj. 1F0-61102-A-35-D)
(AD-730931; WVT-7132; AMCMS-Code-501B.11.35D00.01) Avail: NTIS CSCL 13/13

The Kantorovich method in conjunction with Hamilton's principle is used to develop a simple theory that approximates the classical theory of flexure for thin rectangular elastic plates that are clamped on the edge $x = 0$ and free on the edge $x = 1$. The transverse deflection $w(x, y, t)$ of the plate is represented in the form $f(x)v(y, t)$, where $f(x)$ is a chosen function that satisfies the boundary conditions on the clamped edge and $v(y,t)$ is treated as the independent variation function in Hamilton's principle. The simplified partial differential equation of motion is solved exactly for several free and forced vibration problems; a number of results are compared with experimental data and theoretical results obtained by other methods. The effect of

nonconservative aerodynamic forces included according to the approximations of piston theory, and two flutter analyses are performed for the edges y = 0, H being either simply supported or clamped and perpendicular to the direction of the stream. Plots of the variation of Mach number with thickness-to-length ratio of the plate are presented. Author

N72-14930# Watervliet Arsenal, N.Y. Benet R and E Labs.
SOME CONSERVATIVE AND NONCONSERVATIVE STABILITY PROBLEMS WITH THE LOAD APPLIED AT AN ARBITRARY POINT ALONG THE AXIS OF A BEAM
Eugene J. Brunelle and Gary L. Anderson Jun. 1971 119 p refs
(DA Proj. 1F0-61102-A-35-D)
(AD-730680; WVT-7129) Avail: NTIS CSCL 13/13

Some problems in the theory of stability of elastic bars subjected to conservative and nonconservative loads are solved. The load is applied at an arbitrary point along the length of the beam, and the variation of the critical load with the load position is determined. Exact results are computed according to the appropriate static or dynamic criterion. Three approximate methods are also employed, and the approximate and exact numerical results are compared. These methods consist of Galerkin's procedure and Ritz' method, formulated in terms of a special form of Hamilton's principle and the adjoint problem associated with the original stability problem. Author (GRA)

N72-14931# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ARMY AIRCRAFT PROTECTIVE STRUCTURES DESIGNS. REPORT 3: RESPONSE OF SELECTED MATERIALS TO HIGH-SPEED FRAGMENT IMPACT
Jerry W. Brown and Willis G. Dykes Aug. 1971 32 p refs
(DA-Proj. 4A6-6270-A-859)
(AD-730673; AEWES-TR-N-69-8-3) Avail: NTIS CSCL 19/4

In order to design effective fragment protection schemes that will allow optimum use of time, personnel, and materials, it is necessary to understand the behavior of various materials under fragment impact. Therefore, a study has been conducted using textiles, wood, and earth materials to gain an understanding of the basic physical laws governing their response to fragment impact. Mathematical analyses of the physical characteristics of the various materials as well as experiments in which fragment simulating projectiles were used have yielded insight into the basic mechanics of fragment defeat. Materials were tested by impacting them with projectiles weighing between 17 and 300 grains at velocities ranging from 500 to 5,000 ft/sec. Data from these tests are presented to illustrate the relations between mass, velocity, and penetration depths of the projectiles into ballistic nylon, wood, sand, and clay. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-14932 Washington Univ., Seattle.
AN APPROXIMATE SOLUTION TO THE PROBLEM OF TRANSIENT MELTING OF A GLASSY ABLATION MATERIAL Ph.D. Thesis
Paul Douglas Shennum 1970 84 p
Avail: Univ. Microfilms Order No. 71-1025

The unsteady melting of a glassy material is studied analytically. An approximate solution is provided which describes the response of the material to hypersonic flow. The solution is obtained from a simplified set of equations derived by an order of magnitude analysis from the equations of motion of the liquid layer. These simplified equations are similar to those derived by Ostrach and his collegues. A new physical interpretation of the molten layer is presented. Dissert. Abstr.

N72-14933*# Geoscience, Ltd., Solana Beach, Calif.
HEAT AND MOMENTUM TRANSFER MODEL STUDIES APPLICABLE TO ONCE-THROUGH, FORCED CONVECTION POTASSIUM BOILING
C. M. Sabin and H. F. Poppendiek Washington NASA Sep. 1971 268 p refs
(Contract NAS3-9426)
(NASA-CR-1896; GLR-71) Avail: NTIS CSCL 20M

A number of heat transfer and fluid flow mechanisms that control once-through, forced convection potassium boiling are studied analytically. The topics discussed are: (1) flow through tubes containing helical wire inserts, (2) motion of droplets entrained in vapor flow, (3) liquid phase distribution in boilers, (4) temperature distributions in boiler tube walls, (5) mechanisms of heat transfer regime change, and (6) heat transfer in boiler tubes. Whenever possible, comparisons of predicted and actual performances are made. The model work presented aids in the prediction of operating characteristics of actual boilers. Author

N72-14934*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND TESTING OF THE PYROTECHNIC SUBSYSTEM TO THE MARINER MARS 1971 SPACECRAFT
P. Alexander, comps., J. Earnest, A. Murphy, and J. Quinn 15 Dec. 1971 15 p refs
(Contract NAS7-100)
(NASA-CR-124741; JPL-TM-33-502) Avail: NTIS CSCL 19A

Design, fabrication, and testing of the Mariner Mars 1971 pyrotechnic subsystem are reviewed. Emphasis is placed on those changes from the Mariner Mars 1969 configuration. Major problems occurring in the developmental and testing phases are discussed. Author

N72-14935*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF THE RADIATION FLUX PROFILES AND SPECTRAL DETAIL FROM THREE DETAILED NONGRAY RADIATION MODELS AT CONDITIONS REPRESENTATIVE OF HYPERVELOCITY EARTH ENTRY
John T. Suttles Washington Jan. 1972 27 p refs
(NASA-TM-X-2447; L-7986) Avail: NTIS CSCL 20M

The radiation models were compared on the basis of the approaches used for the transport calculations and absorption coefficients and of results obtained for the radiation flux profiles and spectral distributions. The calculated results were for shock layer conditions representative of manned earth reentry from an interplanetary mission. The three models are RATRAP, RADICAL, and MDAC. The results show that significant differences exist in the radiation flux computed by the three models. The RADICAL model was found to depend on fewer approximations, to include more detail, and to require less computer time than the other models. Author

N72-14936# National Bureau of Standards, Washington, D.C. Cryogenics Div.
ANALYSIS OF P-V-T DATA BY MEANS OF A UNIVERSAL STATE EQUATION
Olav B. Verbeke 29 Sep. 1971 17 p refs
(NBS Proj. 2750141)
(File-71-9) Avail: NTIS

A universal equation of state for fluids is proposed. This equation features the behavior of the ideal gas at zero density, the scaling law behavior near the critical point and the hard sphere gas properties at high temperatures. It has been successfully applied on the low temperature and moderate temperature data of hydrogen. The thermodynamic quantities calculated from this equation are compared to the calculations of Goodwin et al and Michels et al. Author

N72-14937*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLASTIC SET OF SMOOTH LARGE RADII OF CURVATURE THERMAL CONDUCTANCE SPECIMENS AT LIGHT LOADS
Daniel J. McKinzie, Jr. 1972 13 p refs Presented at the 10th Aerosp. Sci. Meeting, San Diego, Calif., 17-19 Jan. 1972; Sponsored by the Am. Inst. of Aeron. and Astronautics
(NASA-TM-X-67981; E-6705) Avail: NTIS CSCL 20M

Thermal contact conductance test data at high vacuum were obtained from two Armco iron specimens having smooth, large radii of curvature, convex, one-half wave length surfaces. The data are compared with calculations based on two macroscopic elastic deformation theories and an empirical expression. Major disagreement with the theories and fair agreement with the empirical expression resulted. Plastic deformation of all the contacting surfaces was verified from surface analyzer statistics. These results indicate that the theoretical assumption of macroscopic elastic deformation is inadequate for accurate prediction of heat transfer with light loads for Armco iron specimens similar to those used in this investigation. Author

N72-14938*# Missouri Univ., Rolla. Dept. of Mechanical and Aerospace Engineering.
THERMODYNAMIC PROPERTIES OF HYDROGEN-HELIUM PLASMAS
H. F. Nelson Washington NASA Nov. 1971 125 p refs
(Grant NGR-26-003-055)
(NASA-CR-1861) Avail: NTIS CSCL 20M

The thermodynamic properties of an atomic hydrogen-helium plasma are calculated and tabulated for temperatures from 10,000 to 100,000 K as a function of the mass fraction ratio of atomic hydrogen. The tabulation is for densities from 10 to the minus 10th power to 10 to the minus 6th power gm/cu cm and for hydrogen mass fraction ratios of 0, 0.333, 0.600, 0.800, and 1.0, which correspond to pure helium, 50 percent hydrogen per unit volume, 75 percent hydrogen per unit volume, 89 percent hydrogen per unit volume, and pure hydrogen plasmas, respectively. From an appended computer program, calculations can be made at other densities and mass fractions. The program output agrees well with previous thermodynamic property calculations for limiting cases of pure hydrogen and pure helium plasmas. Author

N72-14939*# Bellcomm, Inc., Washington, D.C.
TWO FLUID MODEL FOR THERMAL STRATIFICATION IN THE APOLLO CRYOGENIC OXYGEN TANKS
J. A. Saxton 22 Oct. 1971 57 p refs
(Contract NASw-417)
(NASA-CR-124753; TM-71-2031-2; Case-320) Avail: NTIS CSCL 20M

It is observed on Apollo flights that for oxygen densities greater than 42 lb/cu ft the heater operation time to achieve a desired pressure rise is half that which would be required if the energy were uniformly dispersed. A two fluid model was developed to describe this effect of stratification on the tank's pressurization behavior. The increase in pressure rise rate is attributed to compression of the bulk fluid in response to expansion of the heated fluid adjacent to the heater. It is assumed that during the heating operation the adjacent fluid retains nearly all the heater energy and has no mass interaction with the bulk fluid. The hot fluid temperatures predicted by the model are in reasonable correspondence with the observed heater temperatures. The model indicates that the fraction of the fluid interacting with the heater increases with decreasing density, from less than 0.1% at full tank to roughly 1% at 50% quantity, the lowest quantity at which stratification effects on pressure are observed. Author

N72-14940*# Dynamic Science, Irvine, Calif.
FUNDAMENTAL IGNITION STUDY FOR MATERIAL FIRE SAFETY IMPROVEMENT, PART 2 Final Report, 15 Jul. 1970 - 15 May 1971
K. L. Paciorek, R. H. Kratzer, and J. Kaufman Jun. 1971 112 p refs
(Contract NASw-1921)
(NASA-CR-114402) Avail: NTIS CSCL 20M

The autoignition behavior of polymeric compositions in oxidizing media was investigated as well as the nature and relative concentration of the volatiles produced during oxidative decomposition culminating in combustion. The materials investigated were Teflon, Fluorel KF-2140 raw gum and its compounded versions Refset and Ladicote, 45B3 intumenscent paint, and Ames isocyanurate foam. The majority of the tests were conducted using a stagnation burner arrangement which provided a laminar gas flow and allowed the sample block and gas temperatures to be varied independently. The oxidizing atmospheres were essentially air and oxygen, although in the case of the Fluorel family of materials, due to partial blockage of the gas inlet system, some tests were performed unintentionally in enriched air (not oxygen). The 45B3 paint was not amenable to sampling in a dynamic system, due to its highly intumescent nature. Consequently, selected experiments were conducted using a sealed tube technique both in air and oxygen media. Author

N72-14941*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS AND COMPARISON OF WALL COOLING SCHEMES FOR ADVANCED GAS TURBINE APPLICATIONS
Raymond Colladay Washington Jan. 1972 43 p refs
(NASA-TN-D-6633; E-6439) Avail: NTIS CSCL 20M

The relative performance of (1) counterflow film cooling, (2) parallel-flow film cooling, (3) convection cooling, (4) adiabatic film cooling, (5) transpiration cooling, and (6) full-coverage film cooling was investigated for heat loading conditions expected in future gas turbine engines. Assumed in the analysis were hot-gas conditions of 2200 K (3500 F) recovery temperature, 5 to 40 atmospheres total pressure, and 0.6 gas Mach number and a cooling air supply temperature of 811 K (1000 F). The first three cooling methods involve film cooling from slots. Counterflow and parallel flow describe the direction of convection cooling air along the inside surface of the wall relative to the main gas flow direction. The importance of utilizing the heat sink available in the coolant for convection cooling prior to film injection is illustrated. Author

N72-14942*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF HEAT TRANSFER IN A POROUS COOLED WALL WITH VARIABLE PRESSURE AND TEMPERATURE ALONG THE COOLANT EXIT BOUNDARY
Robert Siegel and Marvin E. Goldstein Washington Jan. 1972 37 p refs
(NASA-TN-D-6621; E-6413) Avail: NTIS CSCL 20M

Fluid from a reservior at constant pressure and temperature is forced through a porous wall of uniform thickness. The boundary through which the fluid exits has specified variations in pressure and temperature along it in one direction so that the flow and heat transfer are two-dimensional. The local fluid and matrix temperatures are assumed to be equal and therefore a single energy equation governs the temperature distribution within the wall. The solution is obtained by transforming this energy equation into potential plane coordinates, which results in a separable equation. A technique yielding an integral equation is used to adapt the general solution so that it satisfies the variable-pressure boundary condition. Analytical expressions are given for the normal exit velocity and heat flux along the exit boundary. Illustrative examples are carried out which indicate to what extent the solution is locally one-dimensional. Author

N72-14943*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF LAMINAR GAS JET DIFFUSION FLAMES IN ZERO GRAVITY

Thomas H. Cochran Washington Jan. 1972 28 p
(NASA-TN-D-6523; E-6570) Avail: NTIS CSCL 21B

An experimental program was conducted to study the burning of laminar gas jet diffusion flames in a zero-gravity environment. The tests were conducted in a 2.2-Second-Zero-Gravity Facility and were a part of a continuing effort investigating the effects of gravity on basic combustion processes. The photographic results indicate that steady state gas jet diffusion flames existed in zero gravity but they were geometrically quite different than their normal-gravity counterparts. Methane-air flames were found to be approximately 50 percent longer and wider in zero gravity than in normal gravity. Author

N72-14944*# Minnesota Univ., Minneapolis. Heat Transfer Lab.

A MODEL FOR ANALYSIS OF THE TEMPERATURE FIELD DOWNSTREAM OF A HEATED JET INJECTED INTO AN ISOTHERMAL CROSSFLOW AT AN ANGLE OF 90 DEG

V. L. Eriksen, E. R. G. Eckert, and R. J. Goldstein Jul. 1971 50 p refs
(Contract NAS3-13200)
(NASA-CR-72990; HTL-TR-101) Avail: NTIS CSCL 20M

The temperature distribution downstream of a heated jet entering an isothermal crossflow at an angle of 90 deg is predicted using two conduction models with energy sources above the point of injection, in one case a point source and in the second a line source. The models use effective turbulent diffusivities that are determined empirically from previous measurements. Temperatures predicted by the models are compared to experimental results. Author

N72-14945*# Minnesota Univ., Minneapolis. Heat Transfer Lab.

FILM COOLING EFFECTIVENESS AND HEAT TRANSFER WITH INJECTION THROUGH HOLES

V. L. Eriksen Aug. 1971 179 p refs
(Contract NAS3-13200)
(NASA-CR-72991; HTL-TR-102) Avail: NTIS CSCL 20M

An experimental investigation of the local film cooling effectiveness and heat transfer downstream of injection of air through discrete holes into a turbulent boundary layer of air on a flat plate is reported. Secondary air is injected through a single hole normal to the main flow and through both a single hole and a row of holes spaced at three diameter intervals with an injection angle of 35 deg to the main flow. Two values of the mainstream Reynolds number are used; the blowing rate is varied from 0.1 to 2.0. Photographs of a carbon dioxide-water fog injected into the main flow at an angle of 90 deg are also presented to show interaction between the jet and mainstream. Author

N72-14946*# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.

THERMAL CONTACT RESISTANCE IN A NON-IDEAL JOINT

Richard T. Roca and Borivoje B. Mikic Nov. 1971 233 p refs
(Contract NAS8-24867)
(NASA-CR-12168; DSR-71821-77) Avail: NTIS CSCL 20M

The contact of two rough, wavy surfaces; the contact of two rough but nominally flat plates pressed together over a concentrated area; and the contact of two rough but nominally flat plates bolted together are considered. In each case the pressure distribution is calculated as a function of the surface properties. In the case of wavy surfaces it is found that all necessary information for any combination of parameters can be reduced to one master graph. In the other two cases one such graph is needed for each geometry used. The resulting pressure distributions are used in a specific heat transfer example and the total joint resistance versus roughness is presented. A method for decreasing the resistance by increasing the roughness is shown. Author

N72-14947*# Lockheed Missiles and Space Co., Huntsville, Ala.

SPACE THERMAL CONTROL DEVELOPMENT Final Report

M. J. Hoover, P. G. Grodzka, and M. J. ONeill Dec. 1971 80 p refs
(Contract NAS8-25183)
(NASA-CR-124910; HREC-5183-3; LMSC HREC-D225500) Avail: NTIS CSCL 20M

The results of experimental investigations on a number of various phase change materials (PCMs) and PCMs in combination with metals and other materials are reported. The evaluations include the following PCM system performance characteristics: PCM and PCM/filler thermal diffusivities, the effects of long-term thermal cycling, PCM-container compatibility, and catalyst effectiveness and stability. Three PCMs demonstrated performance acceptable enough to be considered for use in prototype aluminum thermal control devices. These three PCMs are lithium nitrate trihydrate with zinc hydroxy nitrate catalyst, acetamide, and myristic acid. Of the fillers tested, aluminum honeycomb filler was found to offer the most increase in system thermal diffusivity. Author

N72-14948# Drexel Univ., Philadelphia, Pa. Combustion Kinetics Lab.

COMBUSTION KINETICS OF REENTRY VEHICLE ABLATION MATERIALS Annual Summary Report, 1 Jul. 1970 - 30 Jun. 1971

Richard A. Matula Jul. 1971 64 p refs
(Grant AF-AFOSR-1606-68; AF Proj. 9750)
(AD-729934; DUCK-711; AFOSR-TR-71-2139) CSCL 07/4

The thermal decomposition of carbonyl fluoride (COF2) in excess argon was studied behind shock waves in the temperature and total pressure ranges 2600-3600K and 0.5 to 12 atmospheres respectively. The reaction was found to be unimolecular in nature, and the observed rate constant variation with temperature and total pressure was analyzed with the aid of both Lindemann and RRK unimolecular reaction rate theories. The experimentally determined activation energy for the high pressure limiting rate constant was shown to be slightly in excess of the first bond dissociation energy of COF2, and the Lindemann theory was shown to best fit the experimental data. Preliminary shock tube studies of the thermal decomposition of COF2 in the presence of molecular hydrogen have been carried out in the temperature and pressure ranges 2700-3300K and 1.9 to 3.0 respectively. The temperature dependence of the spectral and integrated intensity of the 1943/cm infrared band of carbonyl fluoride was experimentally determined in the temperature range 300-600K. An expression for the temperature dependence of the theoretical band shape of the v2 fundamental vibration of COF2 was developed. The Fermi resonance effects were combined with the theoretical band shape to predict the spectral intensity of the 1943/cm band at temperatures above 600K. Author (GRA)

N72-14949*# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.

FILM COOLING EFFECTIVENESS AND HEAT TRANSFER WITH INJECTION THROUGH HOLES Summary Report

V. L. Eriksen Aug. 1971 178 p refs
(Contract NAS3-13200)
(NASA-CR-72991; HTL-TR-102) Avail: NTIS CSCL 20M

An experimental investigation of the local film cooling effectiveness and heat transfer downstream of injection of air through discrete holes into a turbulent boundary layer of air on a flat plate is reported. Secondary air is injected through a single hole normal to the main flow and through both a single hole and a row of holes spaced at three diameter intervals with an injection angle of 35 deg to the main flow. Two values of the mainstream Reynolds number are used. The blowing rate is varied from 0.1 to 2.0 Photographs of a carbon dioxide-water fog injected into the main flow at an angle of 90 deg are also presented to show interaction between the jet and mainstream. Author

N72-14950# Sandia Labs., Livermore, Calif.
PREDICTION OF AERODYNAMIC HEATING OF FINS ON RE-ENTRY VEHICLES
E. C. Lemmon and H. W. Coleman Jul. 1971 52 p refs
(Contract AT(29-1)-789)
(SCL-RR-710056) Avail: NTIS

A method for predicting the turbulent aerodynamic heating of fins on reentry vehicles is presented. Shock wave/boundary layer interaction methods and infinite swept cylinder theories are examined and are shown to be inadequate to fully describe the problem. A semi-empirical method based on upstream flow parameters and fin geometry for modeling heating on the fin leading edge is developed, and the relative levels of heating on the remainder of the fin and on the vehicle surface in the fin interference region are also assessed. Author (NSA)

N72-14951# Royal Aircraft Establishment, Farnborough (England).
THERMAL BALANCE OF POWER CONVERTERS FOR ION PROPELLED SPACECRAFT
C. Nash Apr. 1970 18 p ref
(RAE-TR-70053; UDC-536.33; UDC-621-714; UDC.621.314.5; UDC-629.19.035.53; UDC-629.19.068.1; TRC-BR-19341) Avail: NTIS

Heat balance experiments designed to investigate the thermal condition of a dc to dc power converter under a simulated space environment are described. An outline of the design of the heat radiator is given together with a description of the method of measuring the thermal performance of the converter. The experiment shows that converters will have comparable efficiencies when in orbit to those achieved while operating in the laboratory. Author (ESRO)

N72-14952# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A PRELIMINARY STUDY OF SPHERICAL DETONATION WAVE SYMMETRY IN STOICHIOMETRIC HYDROGEN-OXYGEN MIXTURES
A. K. MacPherson Wright-Patterson AFB, Ohio ARL Feb. 1971 19 p refs
(Contract AF 33(615)-5313; AF Proj. 7065)
(AD-725806; UTIAS-TN-154; ARL-71-0034;
DoD-Element-61102F; DoD-Subelement-681307) Avail: NTIS CSCL 21/2

A photographic study was undertaken of the detonation wave produced in a hemispherical chamber filled with a H2-O2 mixture at high initial pressures (600 psi). The study was directed at the driving processes in the driver of the UTIAS Implosion-Driven Hypervelocity Launcher. The shape of the luminous front of hemispherical detonation waves were photographed for waves produced in stoichiometric hydrogen-oxygen mixture at initial pressure of between 7 and 27 atmospheres. It was found that the wave pictures were not reproducible when tests were performed under apparently identical conditions. Further, the wave front was not always smooth and often asymmetrical. Author (GRA)

N72-14953# Nevada Univ., Reno.
ERROR PREDICTION FOR THE IMPLICIT NUMERICAL SOLUTION OF THE HEAT CONDUCTION EQUATION Technical Publication, Sep. 1966 - Sep. 1968
J. T. Anderson, William VanTassel, and Alohn F. Stanley Jun. 1971 140 p refs
(Contracts N60530-67-C-0051; N60530-67-C-0278)
(AD-729652) Avail: NTIS CSCL 20/13

The results of an investigation of time- and space-truncation errors inherent in the implicit numerical analysis of the heat conduction equation are presented. Curves showing the percentage of error as a function of Biot and Fourier number for both step-function and ramp-function boundary conditions are given. Acceleration techniques, over-relaxation, and a direct tridiagonal matrix solution are presented. Methods are developed for automatic determination and printout of spatial- and time-truncation error, for extending ramp-function responses for either analytical or numerical solutions, and for synthesizing ramps of different slopes from a given transient response. An automatic time-step generator that maintains a specified error level is described and coded. Preliminary studies correlating the delta first derivative with spatial-truncation error, and accelerating the solution of a three-dimensional implicit transient solution through the use of a one-dimensional approach are given. Author (GRA)

N72-14954# Naval Research Lab., Washington, D.C. Communications Sciences Div.
RADIAL HEAT CONDUCTION IN LASER HEATING OF MATERIAL SLABS Final Report
Robert N. DeWitt 10 Aug. 1971 11 p ref
(NRL Proj. RR002-09-41-5061)
(AD-729642; NRL-7314; NRL-Probl-R07-14) Avail: NTIS

To quantify the cases in which radial heat conduction is important, this report investigates the heating of metal slabs by laser beams with beams with finite diameters. A two-dimensional approach is taken which assumes cylindrical symmetry, and the method of finite differences is used to determine temperature profiles in the slabs as a function of time and incident flux intensity. The times necessary to induce melting at the front surface of the slabs are obtained in the two-dimensional approach and compared with the times obtained in the one-dimensional approach. This gives a direct indication of the importance of radial heat conduction. Author (GRA)

N72-14955# Army Foreign Science and Technology Center, Charlottesville, Va.
TRANSFORMATION OF THE DIFFERENTIAL EQUATIONS OF THERMODYNAMICS BY THE INTRODUCTION OF DIMENSIONLESS PARAMETERS
V. P. Dobrodeev and A. L. Klyachkin 26 Aug. 1971 15 p refs
Transl. into ENGLISH from Teploenergetika (USSR), v. 16, no. 12, 1969 p 81-84
(AD-729481; FSTC-HT-23-464-71; FSTC-T702301-2301; ACSI-Control-No-J-9464) Avail: NTIS CSCL 20/13

The solution of a series of thermodynamic problems can be simplified by the introduction of four dimensionless parameters. Author (GRA)

N72-14956# Rocket Propulsion Establishment, Westcott (England).
COMPETITIVE REALTION KINETICS IN SEEDED FLAMES AND ROCKET EXHAUSTS
D. E. Jensen Feb. 1971 19 p refs
(AD-729706; RPE-TR-71/2; TRC-br-25664; UDC-541.127; UDC-621.455) Avail: NTIS CSCL 21/2

In such nonequilibrium combustion systems as rock exhaust plumes, reactions of the type X + HY = XY + H and X + Y + M = XY +M, where X is a metal atom or free electron, Y is a free radical and M is a collision partner, compete to determine concentration ratios (XY)/(X). Competition criteria suggested by Sugden are modified, extended, and exemplified by reference to particular reactions of practical interest. The criteria help the chemist to select the minimum number of chemical reactions for computer calculations on the properties of combustion systems. Recommended rate coefficients and uncertainties are offered for several reactions of type (A) and (B). Author (GRA)

N72-14957# ARO, Inc., Arnold Air Force Station, Tenn.
EXTERNAL FLOW FIELD EFFECTS ON THE PLUME IMPINGEMENT PRESSURE AND HEAT TRANSFER RATE DISTRIBUTIONS ON A FLAT PLATE Final Report
W. T. Strike, Jr. and D. E. Boylan AEDC Sep. 1971 52 p refs
(Contract F40600-72-C-0003; ARO Proj. VT2128)
(AD-730274; AEDC-TR-71-195; ARO-VKF-TR-71-136;
Program-Element-65802F) Avail: NTIS CSCL 21/2

Experimental plume impingement pressure and heat-transfer-rate distributions on a flat plate with and without an external

Mach number 18 stream are described. The plume was generated by expanding helium through a 1.61 area ratio nozzle, which simulated the initial shape of a rocket exhaust plume produced by a nozzle with an area ratio of 25 operating at an altitude of 262,000 ft. Although the plume generator nozzle conditions were not varied, the quiescent environment conditions and external stream conditions were adjusted so that the general shape and size of the plume remained the same. A higher quiescent pressure environment was required to produce a plume of the same size as the plume obtained in an external stream. Author (GRA)

N72-14958# Harry Diamond Labs., Washington, D.C.
AN IMPROVED TEST TO DETERMINE RAIN-EROSION RESISTANCE IN FUZE NOSE CONES
George K. Lucey, Jr. and Richard Ireland Jul. 1971 63 p refs
(HDL Proj. 72791)
(AD-729927; HDL-TR-1559; AMCMS-4810.16.47341) Avail: NTIS CSCL 19/1

This report proposes that rocket sled tests used in determining rain erosion resistance of fuze nose cones can be improved by specifying the aerodynamic heating that occurs on the nose cone before entering the artificial rainfield. This technique involves defining the velocity profile of the sled during the approach so that at the instant of entry into the rainfield, the velocity, surface temperature, and temperature gradient of the nose cone are as close as possible to the values that occur when the nose cone is mounted on an actual weapon and fired downrange toward a rainstorm. A computer program used to calculate temperatures within the nose-cone tip is presented in this report. Calculations used in preparing for rocket sled tests of the Short Intrusion Fuze (SIF) are presented as a sample problem. Author (GRA)

N72-14959# Army Missile Command, Redstone Arsenal, Ala.
ROCKET PLUME EFFECTS ON BOATTAIL AND FLARE BODIES OF REVOLUTION AT TRANSONIC SPEEDS
Donald V. Rubin 31 May 1971 47 p refs
(DA Proj. 1M2-62303-A-214)
(AD-730669; RD-TR-71-17; AMC-522c.11.214.05) Avail: NTIS CSCL 19/7

The report presents an analysis of the pressure data from a wind tunnel test conducted to gain information about rocket plume effects on missile base pressure and local pressure along flared and boattailed bodies of revolution at transonic speeds. The jet plume was simulated by a cold air jet over a pressure range from 0 to approximately 600 psia. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-14960*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ABBREVIATIONS AND ACRONYMS GUIDE
1 Oct. 1971 25 p
(NASA-CR-125431; JPL-1030-30) Avail: NTIS

A selected list of abbreviations and acronyms in use throughout the Jet Propulsion Laboratory is presented. The compilation includes NASA and JPL facilities and organizations, federal government agencies, international organizations, engineering and scientific associations and societies, commercial organizations, and words and phrases with technical and financial applications. Author

N72-14961# Committee on Aeronautical and Space Sciences (U. S. Senate).
STATEMENTS BY PRESIDENTS OF THE UNITED STATES ON INTERNATIONAL COOPERATION IN SPACE. A CHRONOLOGY: OCTOBER 1957 - AUGUST 1971
1971 136 p
(S-Doc-92-40) Avail: SOD $0.55

Documentation on more than a decade of the national policy for international cooperation in the space program is presented. The statements of four Presidents on the topic of international cooperation are presented. Author

N72-14962# Committee on Science and Astronautics (U. S. House).
CHAPEL OF THE ASTRONAUTS, H.R. 4545
1971 31 p Hearing presented before the Subcomm. on Manned Space Flight of the Comm. on Sci. and Astronautics, 92d Congr., 1st Sess., 23 Sep. 1971
Avail: US Capitol, House Document Room

Hearings held in connection with the proposed Chapel of the Astronauts and the sale of land at Kennedy Space Center to a private firm which plans to construct it are presented. Design concept and estimated cost are considered in an appendix. K.P.D.

N72-14963# Committee on Science and Astronautics (U. S. House).
NASA VISITOR INFORMATION FACILITIES
1971 20 p Rept. of the Subcomm. on NASA Oversight of the Comm. on Sci. and Astronautics at the 92d Congr., 1st Sess.
Avail: US Capitol, House Document Room

A discussion of the visitor programs at NASA installations and facilities is presented. K.P.D.

N72-14964# Committee on Science and Astronautics (U. S. House).
NATIONAL SCIENCE FOUNDATION AUTHORIZATION, 1972
Washington GPO 1971 898 p refs Hearings on H.R. 4743 (superseded by H.R. 7960) before the Comm. on Sci. and Astronaut. and the Subcomm. on Sci., Res., and Develop., 92d Congr., 1st Sess., No. 3, 25 Feb., 5, 23-26, and 30 Mar., and 6-7 Apr. 1971
Avail: Comm. on Sci. and Astronaut.

An overview of the National Science Foundation and its programs is provided in the framework of a bill to authorize appropriations for the fiscal year ending June 30, 1972. G.G.

N72-14965# Committee on Science and Astronautics (U. S. House).
REPORT ON THE ACTIVITIES OF THE COMMITTEE ON SCIENCE AND ASTRONAUTICS, US HOUSE OF REPRESENTATIVES, NINETY-FIRST CONGRESS, FIRST AND SECOND SESSIONS
Charles E. Ducander Washington GPO 31 Dec. 1970 21 p refs Presented to Comm. on Sci. and Astronaut. at 91st Congr., 31 Dec. 1970
Avail: Comm. on Sci. and Astronaut.

The activities of the Committee on Science and Astronautics are reported. A list of the hearings, the public laws resulting from Committee action, investigations and studies, and technology assessments are included. F.O.S.

N72-14966*# Vought Missiles and Space Co., Dallas, Tex.
HISTORY OF THE ITALIAN SAN MARCO EQUATORIAL MOBILE RANGE
H. N. Nesbitt [1971] 138 p refs
(Contract NAS1-10000)
(NASA-CR-111987) Avail: NTIS CSCL 05D

Events leading to the development of the San Marco Equatorial Range are presented. Included are background information leading to the cooperative space program between the United States and Italy, conceptual planning, training activities, equipment design and fabrication, and range utilization.

The technical support provided the San Marco Program by Scout Project Office, and other NASA installations is described. Author

N72-14967# Committee on Aeronautical and Space Sciences (U. S. Senate).
SOVIET SPACE PROGRAMS, 1966-1970
Washington GPO 1971 710 p refs Presented to the Comm. on Aeronaut. and Space Sci., 92d Congr., 1st Sess., 9 Dec. 1971 Prepared by Library of Congr. Sci. Policy Res. Div. and Foreign Affairs Div. of the Congressional Res. Serv. and the European Law Div. of the Law Library
(S-Doc-92-51) Avail: SOD $3.00 as 5271-0263

Detailed information on the Soviet Space Program is presented that encompasses civilian as well as military aspects. Identified are possible Soviet space goals and purposes, organizations, resources, facilities and hardware, past and on-going flight programs, research and applications, and projections of expected future plans, together with international political and legal implications of these policies. G.G.

N72-14968# Committee on Interior and Insular Affairs (U. S. Senate).
OVERSIGHT ON HELIUM CONSERVATION
Washington GPO 1971 98 p refs Hearing before Comm. on Interior and Insular Affairs, 92d Congr., 1st Sess., 23 Mar. 1971
Avail: Subcomm. on Minerals, Mater., and Fuels

The testimony concerning the Department of Interior decision to cancel helium contracts thus terminating the present conservation program is reported. A copy of the letter terminating the helium purchase contracts is included. Helium production and demand are discussed. F.O.S.

N72-14969*# Teledyne ADCOM, Cambridge, Mass.
A DIGITAL MATCHED FILTER TECHNIQUE FOR THE TRACKING AND DATA ACQUISITION SYSTEM Final Report, Feb. - Jul. 1971
Steven M. Sussman Aug. 1971 67 p
(Contract NAS5-20201)
(NASA-CR-122312; G-178-F) Avail: NTIS CSCL 09D

Design information and test results for a breadboard implementation of a digital matched filter for PN sequences are reported. The device is intended to expedite acquisition in PN spread-spectrum communication systems. Author

N72-14970*# National Aeronautics and Space Administration, Washington, D.C.
ESTIMATING THE REDUNDANCY OF INFORMATION IN INDUSTRIAL SAMPLING AND INFORMATION TRANSMISSION SYSTEMS
A. B. Markhasin Sep. 1971 8 p refs Transl. into ENGLISH in "Otsenki Izpytochnosti Soobshcheniy v Promyshlennykh Sistemakh Otbora i Peredachi Informatsii" in "Chetvery Simpozium po Probleme Izbytochnosti v Informatsionnykh Sistemakh" Leningrad, Acad. of Sci. /USSR/, 1970 p 454-460
(NASA-TT-F-13875) Avail: NTIS CSCL 05B

Proposed is a method of estimating the redundancy of informational sources which can be modeled by the sum of a large number of Markov sequences with infrequent transitions. The proposed method is based on the clustering of the resultant sequence's transition probabilities with respect to the characteristic K, which is the number of sequences in which transitions have occurred. The method is also based on calculation of estimates of the redundancy as a function of the probability distribution of the number K or its moments. A theorem is proven which establishes that the air in the redundancy estimate asymptotically tends to zero. It is shown that the redundancy is caused primarily by the nonuniformity in the distribution in the number K for the class of information sources being investigated. Author

N72-14971*# Denver Research Inst., Colo.
AEROSPACE MANAGEMENT TECHNIQUES: COMMERCIAL AND GOVERNMENTAL APPLICATIONS
J. Gordon Milliken and Edward J. Morrison Nov. 1971 221 p refs
(Contract NSR-06-004-081)
(NASA-CR-124728) Avail: NTIS CSCL 05D

A guidebook for managers and administrators is presented as a source of useful information on new management methods in business, industry, and government. The major topics discussed include: actual and potential applications of aerospace management techniques to commercial and governmental organizations; aerospace management techniques and their use within the aerospace sector; and the aerospace sector's application of innovative management techniques. F.O.S.

N72-14972# Commission of the European Communities, Brussels (Belgium).
FOURTH GENERAL REPORT ON THE ACTIVITIES OF THE COMMUNITIES, 1970
Feb. 1971 469 p refs
Avail: NTIS HC $6.00/MF $0.95

The Commission of the European Communities report for 1970 is presented. The policies in the following areas are discussed: social, agricultural, environmental protection, industrial, research and technology, transportation, and relations with the United States. Other topics discussed include the functioning of the Common Market, economic and monetary union, external relations of the Community, and institutions and organs of the Community. F.O.S.

N72-14973# Commission of the European Communities, Brussels (Belgium).
THE AERONAUTICAL AND SPACE INDUSTRIES OF THE COMMUNITY COMPARED WITH THOSE OF THE UNITED KINGDOM AND THE UNITED STATES. VOLUME 1: THE AERONAUTICAL AND SPACE RESEARCH AND DEVELOPMENT
1971 763 p refs 5 Vol.
(Rept-7042-Vol-1) Avail: NTIS

The basic and applied research, and the developmental aspects of the aerospace industry are analyzed for the European Economic Community, the United Kingdom, and the United States. The relationships between R and D, and between the industry and the military, civil, and space markets are studied. The structure and organization of R and D are delineated with respect to government and private operators, public and private funding, and specialized trends. Data on the relative importance and cost of the public and private sectors in the execution of R and D, are discussed. It was found that over the period 1960 to 1967 R and D expenditure on aerospace projects in the EEC countries as a whole increased both in absolute value and as a percentage of the GNP. The EEC is ahead of the United Kingdom with respect to the total amount spent on aerospace R and D, but its GNP is lower than the figure for the U.K.; the gap between the Community and the United States industries was narrowed. Trends in expenditures from 1960 to 1967 are examined, and forecasts for R and D expenditures in 1980 are made. N.E.N.

N72-14974# Commission of the European Communities, Brussels (Belgium).
THE AERONAUTICAL AND SPACE INDUSTRIES OF THE COMMUNITY COMPARED WITH THOSE OF THE UNITED KINGDOM AND THE UNITED STATES. VOLUME 2: THE AERONAUTICAL AND SPACE INDUSTRY
1971 192 p refs 5 Vol.
(Rept-7042-Vol-2) Avail: NTIS

The process of production, changes in aerospace firms, and changes in the economic characteristics of the aerospace industry are analyzed for the European Economic Community, the United Kingdom, and the United States. It is concluded that the European and British aerospace firms are not big enough to

have optimum production runs and their smallness prevents the concentration of technical investments and adoption of new methods of organization of the U.S. industry. The U.S. figures for value of output per head and productivity per head are almost twice those for the EEC and three times those for the U.K. Profits as percentage of own capital for 1966 were 3.80% for France, 5.34% for the U.K., and 15.8% for the U.S., and the annual rate of turnover of total net assets was 0.56 for France, 1.12 for the U.K., and 2.1 for the U.S. It is felt that the structural and operational shortcomings in the European aerospace industry are the result of the inability of the industry, and of the public authorities concerned with it, to program and carry through the production of optimum production runs. N.E.N.

N72-14975# Commission of the European Communities, Brussels (Belgium).
THE AERONAUTICAL AND SPACE INDUSTRIES OF THE COMMUNITY COMPARED WITH THOSE OF THE UNITED KINGDOM AND THE UNITED STATES. VOLUME 3: THE SPACE ACTIVITIES
1971 205 p refs 5 Vol.
(Rept-7042-Vol-3) Avail: NTIS

The space activities of the United States, international agencies, European cooperative agencies, and the programs of the United Kingdom and the individual European countries are discussed. The histories of the various space programs are reviewed, and their current prospects are described. Details are presented on the U.S. military and NASA programs, Intelsat and Comsat, ELDO and ESRO, and the space programs of the United Kingdom, France, Germany, Italy, Belgium, and the Netherlands. Space expenditures of the European countries are compared with those in Britain and the United States, and international cooperation among the European countries and between Europe and the United States is reported. Europe's lag in space activities, the industrial posture in Europe, and the attitudes of the politicians are described. Projections of growth for the EEC countries and the U.K. are presented, and the need for investment and advanced planning is stressed. N.E.N.

N72-14976# Commission of the European Communities, Brussels (Belgium).
THE AERONAUTICAL AND SPACE INDUSTRIES OF THE COMMUNITY COMPARED WITH THOSE OF THE UNITED KINGDOM AND THE UNITED STATES. VOLUME 4: THE AERONAUTICAL MARKET
1971 227 p refs 5 Vol.
(Rept-7042-Vol-4) Avail: NTIS

The markets for civil aircraft and military aircraft and missiles are discussed. With respect to civil aviation, the types and numbers of aircraft, the airline companies, and air traffic are described, and the structure size of the light aircraft market are given. The number and types of civil aircraft in service in 1980 and the demand in the period 1968 to 1979 are estimated. The military aircraft and missile forces, expenditures, and trends in the European Economic Community, the United Kingdom, and the United States are also discussed, and assumptions concerning the development of the demand for military aircraft and missiles in the seventies are emphasized. The international trade in aircraft, airframes, and aircraft engines is described, and details are given on the imports and exports of the Community, the United Kingdom, and the United States. N.E.N.

N72-14977# Commission of the European Communities, Brussels (Belgium).
THE AERONAUTICAL AND SPACE INDUSTRIES OF THE COMMUNITY COMPARED WITH THOSE OF THE UNITED KINGDOM AND THE UNITED STATES. VOLUME 5: TECHNOLOGY: BALANCE OF PAYMENTS, THE ROLE OF THE AEROSPACE INDUSTRY IN THE ECONOMY, CRITICAL ASSESSMENT OF THE RESULTS OF THE SURVEY
1971 88 p refs 5 Vol.
(Rept-7042-Vol-5) Avail: NTIS

Holdings of United States companies in European firms, and of European firms in other European companies are described, and the share of technical and financial exchanges in the European Economic Community aerospace industries is summarized. The areas most affected by spinoffs from the aerospace industry are described, based on the United States experiences. The technical areas are medicine and biology, electronics and electricity, mechanical engineering and materials, chemicals and propulsive systems, and management techniques which may be the most significant spinoff. The most significant aspect of the economic fallout is considered to be the transfer of aerospace technology, at management level, to the solution of important social and economic problems of contemporary society. The influence of the aerospace industry on the economic cycle is illustrated. A critical assessment is made of the EEC aerospace industry's output, markets, and structural problems, and changes in organization and relations with the U.K. industry are suggested. N.E.N.

N72-14978# National Science Foundation, Washington, D.C.
STATEMENT OF FISCAL YEAR 1973 BUDGET
Jack Renirie 24 Jan. 1972 27 p
(NSF-72-106) Avail: NTIS

The National Science Foundation's budget request for fiscal year 1973 is presented. A dollar breakdown for each program to be researched is given. E.H.W.

N72-14979# European Space Research Organization, Paris (France).
SPACE DOCUMENTATION SERVICE: OPERATIONS HANDBOOK
D. I. Rait May 1971 48 p
(ESRO-SP-63) Avail: NTIS

An account is given of RECON, the on-line, interactive information retrieval system made available to ESRO by NASA. This system provides a means for describing a search interest to a computer, for obtaining displays and printout of results and for redefining the search based on examination of intermediate results. The search routine is described and types of search strategies discussed. The necessary hardware and software are briefly considered and proposals are made for development of new features to improve results. Author (ESRO)

N72-14980# Illinois Univ., Urbana. Coordinated Science Lab.
SERIAL TRANSLATION OF BINARY BLOCK CODES
Steve Alan Francis Aug. 1971 48 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-15459)
(AD-730118; R-520; UILU-ENG-71-2223) Avail: NTIS CSCL 09/4

The report examines the serial translation of binary block codes, a topic in the field of automata theory. The translation described is a one-to-one, onto, and exhaustive mapping from the 2(Sup N) input code words of N bits each to the 2(Sup N) ouput code words of N bits each. The translation procedure utilizes a Mealy-type synchronous machine translator with a single input, single output, and synchronizing clock rate that is equal to the input bit rate. The thesis will classify all translations of this type by their resultant translator behavior and structure, and will calculate the number of translations in each classification. Methods will be presented to place any given translation into one of these classifications, and to find the translator state requirements and associated state transition table for the translations of each classification. Author (GRA)

N72-14981# Dayton Univ. Research Inst., Ohio.
EVALUATION OF THE SELECTIVE DISSEMINATION OF INFORMATION (SDI) PROGRAM FOR THE AEROSPACE MATERIALS INFORMATION CENTER Final Summary Report, 1 Dec. 1969 - 30 Nov. 1970
Frederic L. Scheffler and Jacqueline G. March Wright-Patterson AFB, Ohio AFML Mar. 1971 89 p refs
(Contract F33615-69-C-1128; AF Proj. 7381)

(AD-725036; UDRI-TR-71-04; AFML-TR-71-11) Avail: NTIS CSCL 05/2

The SDI data base consists of the periodic document index records input to the AMIC system. The users served by the SDI program are 63 engineers, scientists and technical administrators at the AFML and 16 scientific and technical personnel at the University of Dayton. The scope of interest encompasses all materials of current or potential use in aerospace systems and includes theoretical studies, manufacturing processes, and in-service performance and failure analysis. An informal interview technique elicited responses regarding the user assessment of the program and indicated problem areas in the SDI returns received by the users. Most respondents indicated that too many abstracts were being received and relevance was too low. Based on more precise statements obtained in the interviews and on rejected abstracts, profile modifications were effected. An SDI experiment to test the effect of profile modifications on relevance indicated that overall relevance was increased from 37.6% to 51.8%. The primary factor in the improvement was the judicious but copious use of NOT terms to eliminate unwanted abstracts while retrieving desired abstracts. Results showed the validity of the NOT strategy and indicated the effectiveness of direct contact between the information specialist and the SDI user. Author (GRA)

N72-14982# American Inst. for Research, Pittsburgh, Pa.

ANALYSES OF US ARMY ACCIDENT DATA

Clifford P. Hahn Alexandria, Va. Human Resources Res. Organ. Jun. 1971 70 p

(Contract DAHC19-70-C-0012; DA Proj. 2Q0-62107-A-712)

(AD-730881; HUMRRO-TR-71-14) Avail: NTIS CSCL 12/12

Existing U.S. Army Accident Record data were analyzed, seeking relationships that would lead to recommendations for future routine analyses of such data which might help reduce the number and severity of accidents. Numerous computer analysis printouts were submitted to the sponsoring agency. The report describes project activities, distributional results, regression analysis results, and results from a method for comparing relative accident involvement rates. Characteristics of the existing record system and the types of analyses that can be conducted are also discussed. The general conclusion is that the present system seems adequate for inventorying accidents but not to identify human factors associated with on-and-off duty accident experiences; to identify material and equipment design and use characteristics associated with on-duty accidents; or to determine man/vehicle/equipment interactions and their influences on accident and injury incidents. Author (GRA)

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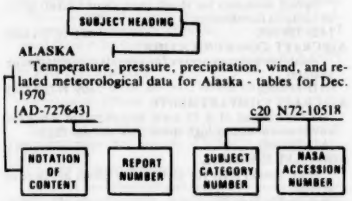

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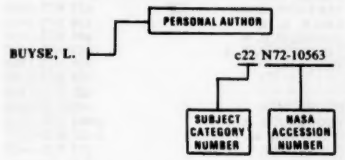

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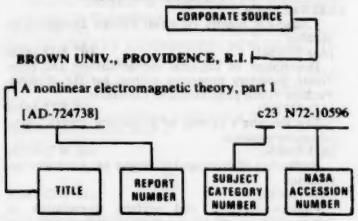

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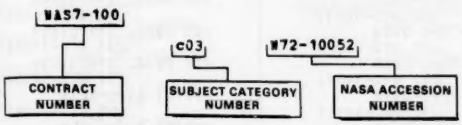

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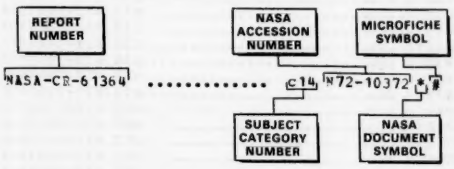

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AFCRL-ERP-361 ..... c04 N72-14048 #

AFCRL-PSRP-45 ..... c09 N72-14244 #
AFCRL-PSRP-458 ..... c23 N72-14716 #

AFCRL-71-039 ..... c08 N72-14222 #
AFCRL-71-0144 ..... c13 N72-14396 #
AFCRL-71-0160 ..... c30 N72-14833*#
AFCRL-71-0233 ..... c13 N72-14394 #
AFCRL-71-0295 ..... c13 N72-14391 #
AFCRL-71-0309 ..... c26 N72-14778 #

AFCRL-71-0322 ..... c07 N72-14195 #
AFCRL-71-0328 ..... c30 N72-14862 #
AFCRL-71-0358 ..... c24 N72-14742 #
AFCRL-71-0368 ..... c09 N72-14244 #
AFCRL-71-0369 ..... c23 N72-14716 #
AFCRL-71-0370 ..... c16 N72-14525 #
AFCRL-71-0377 ..... c04 N72-14048 #
AFCRL-71-0378 ..... c16 N72-14535 #
AFCRL-71-0383 ..... c26 N72-14766 #
AFCRL-71-0388-PT-1 ..... c13 N72-14410 #
AFCRL-71-0418 ..... c07 N72-14201 #
AFCRL-71-0427 ..... c20 N72-14663 #
AFCRL-71-0429 ..... c07 N72-14199 #
AFCRL-71-0458 ..... c07 N72-14202 #

AFCS-7-ORR-71 ..... c07 N72-14196 #

AFETR-TR-71-4 ..... c30 N72-14864 #

AFFDL-TR-71-6 ..... c02 N72-14007 #
AFFDL-TR-71-21 ..... c12 N72-14324 #
AFFDL-TR-71-58 ..... c02 N72-14000 #
AFFDL-TR-71-62-VOL-1 ..... c02 N72-13998 #
AFFDL-TR-71-62-VOL-2 ..... c02 N72-13996 #
AFFDL-TR-71-62-VOL-3 ..... c02 N72-13997 #
AFFDL-TR-71-67 ..... c32 N72-14924 #
AFFDL-TR-71-68 ..... c18 N72-14605 #

AFFTC-TD-71-3 ..... c02 N72-14005 #

AFHRL-TR-71-16 ..... c05 N72-14129 #

AFIT-TR-71-3 ..... c30 N72-14868 #

AFML-TR-71-11 ..... c34 N72-14981 #
AFML-TR-71-67 ..... c26 N72-14779 #
AFML-TR-71-94 ..... c15 N72-14508 #
AFML-TR-71-129-VOL-2 ..... c15 N72-14509 #
AFML-TR-71-145 ..... c32 N72-14925 #

AFOSR-TR-71-0947 ..... c16 N72-14532 #
AFOSR-TR-71-2139 ..... c33 N72-14948 #
AFOSR-TR-71-2412 ..... c08 N72-14226 #
AFOSR-TR-71-2419 ..... c14 N72-14481 #

AFOSR-71-1777TR ..... c16 N72-14529 #
AFOSR-71-1968TR ..... c27 N72-14787 #
AFOSR-71-2140TR ..... c28 N72-14806 #
AFOSR-71-2285TR ..... c12 N72-14332 #
AFOSR-71-2336TR ..... c25 N72-14758 #
AFOSR-71-2338TR ..... c19 N72-14637 #
AFOSR-71-2367TR ..... c13 N72-14406 #
AFOSR-71-2368TR ..... c13 N72-14408 #
AFOSR-71-2369TR ..... c13 N72-14407 #
AFOSR-71-2370TR ..... c13 N72-14411 #
AFOSR-71-2371TR ..... c13 N72-14405 #
AFOSR-71-2372TR-VOL-1 ..... c13 N72-14415 #
AFOSR-71-2373TR-VOL-2 ..... c13 N72-14416 #
AFOSR-71-2390TR ..... c24 N72-14740 #
AFOSR-71-2411TR ..... c10 N72-14269 #
AFOSR-71-2415TR ..... c19 N72-14636 #
AFOSR-71-2416TR ..... c07 N72-14198 #
AFOSR-71-2417TR ..... c21 N72-14684 #
AFOSR-71-2420TR ..... c17 N72-14578 #
AFOSR-71-2470TR ..... c07 N72-14208 #

AFRCL-71-0380 ..... c20 N72-14649 #

AFRPL-TR-71-73 ..... c11 N72-14287 #
AFRPL-TR-71-91 ..... c27 N72-14786 #
AFRPL-TR-71-92 ..... c15 N72-14511 #

AFSWC-TR-71-7 ..... c11 N72-14280 #

AGARD-CP-89-71 ..... c05 N72-14090 #

AGC-1335-2 ..... c13 N72-14402 #

AMC-MS-CODE-501A.11.84400.02 ..... c15 N72-14513 #
AMC-MS-CODE-522C.11.21410 ..... c08 N72-14229 #

AMC-501B.11.02800 ..... c26 N72-14780 #
AMC-522C.11.214.05 ..... c33 N72-14959 #
AMC-4440.15.1100 ..... c08 N72-14231 #

AMCMS-CODE-501B.11.35D00.01 ..... c32 N72-14929 #
AMCMS-CODE-502E.11.299 ..... c32 N72-14923 #
AMCMS-CODE-502E.11.295000 ..... c18 N72-14600 #

AMCMS-4810.16.47341 ..... c33 N72-14958 #

AMMRC-CR-71-9 ..... c17 N72-14564 #

AMMRC-TR-71-26 ..... c26 N72-14777 #
AMMRC-TR-71-29 ..... c32 N72-14923 #
AMMRC-TR-71-31 ..... c32 N72-14928 #

AMRL-TR-70-29 ..... c05 N72-14121 #
AMRL-TR-70-78 ..... c05 N72-14131 #
AMRL-TR-70-131 ..... c08 N72-14227 #
AMRL-TR-71-7 ..... c05 N72-14137 #
AMRL-TR-71-9 ..... c05 N72-14122 #
AMRL-TR-71-20 ..... c02 N72-14013 #
AMRL-TR-71-23 ..... c09 N72-14256 #
AMRL-TR-71-36 ..... c05 N72-14132 #
AMRL-TR-71-74 ..... c04 N72-14052 #

AMS-CODE-4931.OM.6350.1.03 ..... c17 N72-14575 #

AMS-971 ..... c02 N72-14021 #

AP-99 ..... c13 N72-14380 #

AR-1 ..... c03 N72-14039 #
AR-2 ..... c07 N72-14185 #
AR-2 ..... c24 N72-14742 #
AR-3 ..... c07 N72-14184 #

AR/0000/69/000/5/5 ..... c07 N72-14183 #

ARL-71-0034 ..... c33 N72-14952 #
ARL-71-0063 ..... c19 N72-14630 #
ARL-71-0065 ..... c12 N72-14313 #
ARL-71-0080 ..... c25 N72-14753 #
ARL-71-0086 ..... c14 N72-14475 #

ARL/A-NOTE-331 ..... c14 N72-14462 #
ARL/ME-132 ..... c14 N72-14461 #
ARL/MET-74 ..... c17 N72-14553 #
ARL/SM-NOTE-367 ..... c19 N72-14626 #
ARL/SM-368 ..... c32 N72-14909 #
ARL/SYS-NOTE-27-PT-1 ..... c08 N72-14220 #

ARO-ETP-TR-71-52 ..... c11 N72-14279 #

ARO-PWT-TR-71-118 ..... c25 N72-14757 #
ARO-PWT-TR-71-124 ..... c14 N72-14479 #

ARO-VKF-TR-71-136 ..... c33 N72-14957 #

ARO-VKF-71-50 ..... c14 N72-14471 #

AROD-4176-4-P ..... c23 N72-14719 #
AROD-4753-13-E ..... c18 N72-14609 #
AROD-5596-10-E ..... c18 N72-14607 #
AROD-5606-14-E ..... c32 N72-14919 #
AROD-5606-15-E ..... c18 N72-14601 #
AROD-6647-28-M ..... c19 N72-14634 #
AROD-7692-10-P ..... c16 N72-14533 #
AROD-8016-5-MC ..... c17 N72-14581 #

ARPA-CODE-0D10 ..... c26 N72-14776 #

ARPA-TIO-71-11-VOL-2 ..... c13 N72-14404 #

ASD-TDR-62-100 ..... c02 N72-14000 #

ATR-1 ..... c06 N72-14149 #

AVA-FB-7042 ..... c12 N72-14306 #
AVA-FB-7046 ..... c01 N72-13981 #
AVA-FB-7107 ..... c02 N72-13995 #

AVSER-4200-17-10 ..... c02 N72-14006 #
AVSER-9130-71-3 ..... c27 N72-14784 #

AWS-TR-221 ..... c13 N72-14403 #

BAC-8489-945001 ..... c28 N72-14790*#

BBC-1971/44 ..... c07 N72-14152

BESRL-TRN-226 ..... c08 N72-14230 #

BMBW-FB-W-70-16 ..... c22 N72-14689*#

BNWL-SA-3608 ..... c04 N72-14047*#

BNWL-SA-3827 ..... c22 N72-14692 #
BNWL-SA-3921 ..... c26 N72-14763 #
BNWL-SA-3955 ..... c14 N72-14466 #
BNWL-SA-3966 ..... c17 N72-14555 #

BPAC-681303 ..... c11 N72-14285 #
BPAC-681304 ..... c11 N72-14285 #
BPAC-681307 ..... c11 N72-14285 #

BPSN-7(63-301206-6205214-1) ..... c28 N72-14804 #
BPSN-7(63-301206-6205214-2) ..... c28 N72-14805 #

BR-6410 ..... c07 N72-14195 #
BR-21439 ..... c30 N72-14859 #

BRL-CR-43 ..... c25 N72-14759 #

BRL-MR-2100 ..... c17 N72-14580 #
BRL-MR-2110 ..... c20 N72-14655 #

BRL-1536 ..... c05 N72-14120 #
BRL-1543-PT-2 ..... c12 N72-14310 #
BRL-1545 ..... c30 N72-14867 #

871-10001 ..... c30 N72-14838*#

C-108 ..... c06 N72-14151 #
C-72720 ..... c14 N72-14481 #

CAL-BM-2820-F-1 ..... c02 N72-14004 #
CAL-BM-2821-F-5-A ..... c02 N72-14008 #

CALT-68-X-4 ..... c30 N72-14857 #

CAM-110-13 ..... c25 N72-14759 #

CASE-105-9 ..... c20 N72-14642*#
CASE-310 ..... c30 N72-14838*#
CASE-310 ..... c30 N72-14840*#
CASE-320 ..... c33 N72-14939*#
CASE-340 ..... c14 N72-14454*#
CASE-340 ..... c14 N72-14455*#
CASE-340 ..... c30 N72-14837*#
CASE-340 ..... c30 N72-14839*#

CCL-293 ..... c18 N72-14600 #

CEA-CONF-1640 ..... c23 N72-14705 #

CEA-R-4140 ..... c17 N72-14556 #

CERL-PR-M-7 ..... c17 N72-14569 #

CERN-71-4 ..... c07 N72-14178 #

CER70-71TY-RNM62 ..... c12 N72-14329 #

CMR-71-15 ..... c06 N72-14149 #

CODE-G1101D ..... c20 N72-14658 #

CODE-9E20 ..... c23 N72-14721 #
CODE-427 ..... c23 N72-14714 #
CODE-80020 ..... c11 N72-14288 #

CONF-700932-1 ..... c23 N72-14705 #
CONF-710217-1 ..... c05 N72-14119 #
CONF-710418-19 ..... c11 N72-14275 #
CONF-710601-7 ..... c26 N72-14763 #
CONF-710601-8 ..... c17 N72-14555 #
CONF-710617-32 ..... c22 N72-14692 #
CONF-710709-1 ..... c09 N72-14239 #
CONF-710714-1 ..... c14 N72-14466 #
CONF-710803-2 ..... c22 N72-14690 #
CONF-710807-1 ..... c13 N72-14385 #
CONF-710904-1 ..... c02 N72-13994 #
CONF-711003-1 ..... c23 N72-14706 #

CONTRIB-77 ..... c20 N72-14643 #

CSO-0575/72-W ..... c18 N72-14594 #
CSO-0575/72-W ..... c24 N72-14734 #
CSO-0962172-S ..... c16 N72-14519 #

CW-WR-70-024F ..... c15 N72-14514 #

DA-TR-71-8 ..... c31 N72-14900 #

DA-0C4693 ..... c32 N72-14923 #

DASA-2501-5-VOL-5 ..... c17 N72-14573 #

DATA-ITEM-35 ..... c03 N72-14022*#

DCN-1-9-53-20030 ..... c27 N72-14782*#
DCN-1-9-53-20030 ..... c27 N72-14782*#
DCN-1-9-75-10061(3F) ..... c27 N72-14783*#

DDC-TAS-71-31-1-VOL-1 ..... c04 N72-14049 #
DDC-TAS-71-37-1-VOL-1 ..... c12 N72-14331 #
DDC-TAS-71-38 ..... c16 N72-14527 #
DDC-TAS-71-42 ..... c16 N72-14517 #
DDC-TAS-71-43 ..... c02 N72-13983 #

DESY-R-1-70/4 ..... c22 N72-14693 #

DGLR-70-040 ..... c02 N72-13993*#

DGS-152 ..... c13 N72-14391 #

DIA-TASK-T65-01-82 ..... c17 N72-14583 #
DIA-TASK-T65-01-83 ..... c17 N72-14583 #
DIA-TASK-T65-04-18A ..... c31 N72-14904 #
DIA-TASK-T65-05-20 ..... c07 N72-14183 #
DIA-TASK-T66-01-8 ..... c17 N72-14579 #
DIA-TASK-T68-01-02 ..... c17 N72-14568 #
DIA-TASK-T69-04-9 ..... c26 N72-14764 #
DIA-TASK-T70-01-03 ..... c09 N72-14257 #
DIA-TASK-T70-01-03 ..... c13 N72-14419 #
DIA-TASK-T70-02-01 ..... c09 N72-14257 #
DIA-TASK-T70-02-01D ..... c13 N72-14419 #

DIA-T65-01-82 ..... c15 N72-14505 #
DIA-T65-01-83 ..... c15 N72-14505 #

DISS-4182 ..... c19 N72-14627*#
DISS-4471 ..... c10 N72-14260 #
DISS-4518 ..... c10 N72-14261 #
DISS-4546 ..... c26 N72-14760 #

DLR-FB-70-65 ..... c12 N72-14306 #
DLR-FB-70-67 ..... c01 N72-13981 #
DLR-FB-71-24 ..... c12 N72-14307 #
DLR-FB-71-37 ..... c02 N72-13995 #

DMS-DR-1181 ..... c31 N72-14874*#
DMS-DR-1204 ..... c31 N72-14876*#
DMS-DR-1208 ..... c31 N72-14875*#

DNA-SUBTASK-HC-04001 ..... c25 N72-14752 #

DOD-ELEMENT-61101D ..... c26 N72-14778 #
DOD-ELEMENT-61102F ..... c04 N72-14048 #
DOD-ELEMENT-61102F ..... c07 N72-14199 #
DOD-ELEMENT-61102F ..... c12 N72-14313 #
DOD-ELEMENT-61102F ..... c13 N72-14410 #
DOD-ELEMENT-61102F ..... c14 N72-14475 #
DOD-ELEMENT-61102F ..... c19 N72-14630 #
DOD-ELEMENT-61102F ..... c25 N72-14753 #
DOD-ELEMENT-61102F ..... c33 N72-14952 #
DOD-ELEMENT-61102H ..... c23 N72-14716 #
DOD-ELEMENT-62101F ..... c13 N72-14391 #
DOD-ELEMENT-62101F ..... c13 N72-14394 #
DOD-ELEMENT-62101F ..... c16 N72-14525 #
DOD-ELEMENT-62101F ..... c20 N72-14663 #
DOD-ELEMENT-62301D ..... c30 N72-14833*#
DOD-ELEMENT-62702F ..... c09 N72-14244 #

DOD-SUBELEMENT-681000 ..... c09 N72-14244 #
DOD-SUBELEMENT-681000 ..... c13 N72-14391 #
DOD-SUBELEMENT-681000 ..... c13 N72-14394 #
DOD-SUBELEMENT-681300 ..... c04 N72-14048 #
DOD-SUBELEMENT-681300 ..... c13 N72-14410 #
DOD-SUBELEMENT-681300 ..... c16 N72-14525 #
DOD-SUBELEMENT-681301 ..... c14 N72-14475 #
DOD-SUBELEMENT-681301 ..... c25 N72-14753 #
DOD-SUBELEMENT-681304 ..... c19 N72-14630 #
DOD-SUBELEMENT-681305 ..... c07 N72-14199 #
DOD-SUBELEMENT-681307 ..... c12 N72-14313 #
DOD-SUBELEMENT-681307 ..... c33 N72-14952 #
DOD-SUBELEMENT-686670 ..... c20 N72-14663 #

DRI-2561 ..... c13 N72-14396 #

DRL-184-58 ..... c31 N72-14874*#
DRL-184-58 ..... c31 N72-14876*#

DRS-61102F ..... c11 N72-14285 #

DS/EE-71-3 ..... c08 N72-14228 #
DS/MC/71-1 ..... c32 N72-14917 #

DSR-71821-77 ..... c33 N72-14946*#

DUCK-711 ..... c33 N72-14948 #

D180-12700-1 ..... c03 N72-14029*#
D213-10000-1-VOL-1 ..... c02 N72-13998 #
D213-10000-2-VOL-2 ..... c02 N72-13996 #
D213-10000-3-VOL-3 ..... c02 N72-13997 #

E-132F.1 ..... c12 N72-14328 #
E-5503 ..... c24 N72-14728*#
E-6255 ..... c18 N72-14587*#
E-6367 ..... c31 N72-14879*#
E-6413 ..... c33 N72-14942*#
E-6439 ..... c33 N72-14941*#
E-6446 ..... c03 N72-14027*#
E-6500 ..... c17 N72-14550*#
E-6527 ..... c06 N72-14147*#
E-6538 ..... c24 N72-14729*#
E-6564 ..... c28 N72-14791*#
E-6565 ..... c28 N72-14795*#
E-6568 ..... c18 N72-14588*#
E-6570 ..... c33 N72-14943*#
E-6572 ..... c15 N72-14484*#
E-6582 ..... c03 N72-14026*#
E-6610 ..... c03 N72-14028*#
E-6660 ..... c25 N72-14745*#
E-6681 ..... c17 N72-14546*#
E-6684 ..... c17 N72-14547*#
E-6690 ..... c28 N72-14792*#
E-6698 ..... c12 N72-14301*#
E-6699 ..... c28 N72-14793*#
E-6703 ..... c12 N72-14302*#
E-6704 ..... c17 N72-14548*#
E-6705 ..... c33 N72-14937*#
E-6706 ..... c06 N72-14142*#
E-6714 ..... c28 N72-14794*#
E-6716 ..... c08 N72-14213*#
E-6717 ..... c17 N72-14549*#
EA-TR-4535 ..... c05 N72-14127 #
EA-TR-4545-PT-2 ..... c14 N72-14477 #

ECD-516-2 ..... c26 N72-14774 #

ECOM-0084-3 ..... c21 N72-14674 #
ECOM-0110-4 ..... c07 N72-14181 #
ECOM-0110-5 ..... c07 N72-14200 #
ECOM-0112-F ..... c07 N72-14176 #
ECOM-0129-1 ..... c03 N72-14039 #
ECOM-0164-F ..... c09 N72-14254 #
ECOM-0173-F ..... c03 N72-14037 #
ECOM-0223-2 ..... c09 N72-14252 #
ECOM-0229-F ..... c07 N72-14187 #
ECOM-0268-2 ..... c09 N72-14246 #
ECOM-0359-F2 ..... c13 N72-14389 #
ECOM-0392-F ..... c18 N72-14599 #
ECOM-3463 ..... c07 N72-14207 #
ECOM-5382 ..... c20 N72-14654 #
ECOM-5383 ..... c20 N72-14665 #
ECOM-5385 ..... c20 N72-14653 #
ECOM-5387 ..... c20 N72-14652 #

ES-56 ..... c20 N72-14650 #
ES-69 ..... c11 N72-14283 #

ESD-TR-71-208-PT-1-REV ..... c09 N72-14250 #
ESD-TR-71-217 ..... c26 N72-14765 #

ESL-3098-1 ..... c09 N72-14243 #

ESRIN-IN-126-REV ..... c30 N72-14858 #

ESRO-CR-32-IR-2 ..... c03 N72-14036 #
ESRO-CR-39 ..... c09 N72-14241 #
ESRO-CR-43 ..... c21 N72-14675 #

ESRO-SP-63 ..... c34 N72-14979 #

ESRO-TN-29-ESTEC ..... c30 N72-14860 #

ETL-CR-71-11 ..... c13 N72-14393 #

EUR-4619 ..... c24 N72-14737 #

EW-71-4 ..... c07 N72-14182 #

EXPT-D013 ..... c05 N72-14062*#

EXPT-M001 ..... c05 N72-14054*#
EXPT-M003 ..... c05 N72-14058*#
EXPT-M004 ..... c05 N72-14055*#
EXPT-M005 ..... c05 N72-14059*#
EXPT-M006 ..... c04 N72-14056*#
EXPT-M007 ..... c04 N72-14057*#
EXPT-M008 ..... c05 N72-14060*#
EXPT-M009 ..... c04 N72-14061*#

EXPT-S002 ..... c04 N72-14065*#
EXPT-S003 ..... c04 N72-14064*#
EXPT-S004 ..... c04 N72-14063*#
EXPT-S008 ..... c05 N72-14062*#

F-B2299 ..... c05 N72-14117*#

F-C2762 ..... c15 N72-14487*#

FA-A71-7 ..... c15 N72-14513 #

FAA-AM-70-16 ..... c02 N72-13989 #
FAA-AM-71-39 ..... c05 N72-14116 #

FAA-AV-71-1 ..... c11 N72-14289 #

FAA-NA-72-2 ..... c11 N72-14273 #

FAA-RD-71-26 ..... c02 N72-14008 #
FAA-RD-71-104 ..... c11 N72-14273 #

FASC-97 ..... c14 N72-14467 #

FILE-1-0016 ..... c02 N72-13990 #
FILE-71-9 ..... c33 N72-14936 #

FOA-2-B2027-91 ..... c18 N72-14596 #

FR-2 ..... c13 N72-14402 #
FR-8 ..... c18 N72-14599 #

FRO-9-1971 ..... c02 N72-14012 #

FSTC-HT-23-433-71 ..... c18 N72-14598 #
FSTC-HT-23-449-71 ..... c10 N72-14267 #
FSTC-HT-23-463-71 ..... c19 N72-14631 #
FSTC-HT-23-464-71 ..... c33 N72-14955 #
FSTC-HT-23-500-71 ..... c17 N72-14571 #
FSTC-HT-23-505-71 ..... c18 N72-14604 #
FSTC-HT-23-536-71 ..... c18 N72-14597 #
FSTC-HT-23-751-71 ..... c17 N72-14560 #
FSTC-HT-23-816-71 ..... c23 N72-14708 #
FSTC-HT-23-855-71 ..... c09 N72-14242 #
FSTC-HT-23-1013-71 ..... c17 N72-14572 #
FSTC-HT-23-1166-71 ..... c19 N72-14629 #
FSTC-HT-23-1185-71 ..... c16 N72-14523 #
FSTC-HT-23-1264-71 ..... c21 N72-14682 #
FSTC-HT-23-1284-71 ..... c14 N72-14470 #
FSTC-HT-23-1348-71 ..... c02 N72-13999 #

FSTC-T702301-2301 ..... c33 N72-14955 #

FTD-HC-23-321-71 ..... c32 N72-14920 #
FTD-HC-23-334-71 ..... c13 N72-14399 #
FTD-HC-23-367-71 ..... c13 N72-14412 #
FTD-HC-23-368-71 ..... c13 N72-14400 #
FTD-HC-23-369-71 ..... c13 N72-14418 #
FTD-HC-23-371-71 ..... c13 N72-14413 #
FTD-HC-23-386-71 ..... c17 N72-14568 #

FTD-HT-23-324-71 ..... c14 N72-14472 #
FTD-HT-23-792-71 ..... c17 N72-14579 #

FTD-MT-24-05-71 ..... c31 N72-14904 #
FTD-MT-24-16-71 ..... c17 N72-14583 #
FTD-MT-24-23-71 ..... c02 N72-14003 #
FTD-MT-24-34-71 ..... c26 N72-14764 #
FTD-MT-24-43-71 ..... c17 N72-14561 #
FTD-MT-24-44-71 ..... c15 N72-14499 #
FTD-MT-24-52-71 ..... c26 N72-14781 #
FTD-MT-24-53-71 ..... c15 N72-14500 #
FTD-MT-24-88-71 ..... c09 N72-14257 #
FTD-MT-24-100-71 ..... c23 N72-14720 #
FTD-MT-24-106-71 ..... c07 N72-14183 #
FTD-MT-24-114-71 ..... c13 N72-14419 #
FTD-MT-24-125-71 ..... c13 N72-14390 #
FTD-MT-24-131-71 ..... c15 N72-14505 #

FTS-HT-23-887-71 ..... c15 N72-14503 #

FY-7121-N-03188 ..... c08 N72-14222 #

F71-07-VOL-1 ..... c31 N72-14884*#
F71-07-VOL-2 ..... c31 N72-14885*#
F71-07-VOL-3-APP ..... c31 N72-14886*#

G-178-F ..... c34 N72-14969*#

GA/MC/71-5 ..... c08 N72-14224 #
GA/MC/71-7 ..... c32 N72-14918 #

GDC-DAA70-004-VOL-1 ..... c31 N72-14891*#
GDC-DAA70-004-VOL-2 ..... c31 N72-14892*#
GDC-DAA70-004-VOL-3 ..... c31 N72-14893*#
GDC-DAA70-004-VOL-5-BK-1-APP-A .... c31 N72-14894*#
GDC-DAA70-004-5-BK-2 ..... c31 N72-14895*#

GDCA-DBG71-009 ..... c15 N72-14483*#

GE/EE/71S-1 ..... c30 N72-14869 #

GEP/PH/71-12 ..... c25 N72-14754 #

GGC/EE/71-3 ..... c31 N72-14902 #
GGC/EE/71-4 ..... c31 N72-14903 #
GGC/EE/71-6 ..... c02 N72-14016 #
GGC/EE/71-8 ..... c02 N72-14014 #
GGC/EE/71-10 ..... c05 N72-14134 #
GGC/EE/71-17 ..... c02 N72-13992 #
GGC/EE/71-20 ..... c02 N72-14015 #
GGC/EE/71-21 ..... c21 N72-14683 #
GGC/EE/71-24 ..... c05 N72-14133 #
GGC/EE/71-25 ..... c31 N72-14901 #

GIT-A-1231-TR-1 ..... c07 N72-14190 #
GIT-A-1277-TR-2 ..... c21 N72-14685 #

GLR-71 ..... c33 N72-14933*#

GULF-RT-10394 ..... c22 N72-14694 #

HASL-243 ..... c24 N72-14736 #

HDL-TR-1559 ..... c33 N72-14958 #

HEL-TM-8-71 ..... c05 N72-14136 #

HREC-5183-3 ..... c33 N72-14947*#

HSER-5832-PH-1 ..... c15 N72-14504 #
HSER-5834 ..... c23 N72-14709 #
HSER-5835 ..... c08 N72-14223 #

HTL-TR-101 ..... c33 N72-14944*#
HTL-TR-102 ..... c33 N72-14945*#
HTL-TR-102 ..... c33 N72-14949*#

HUMRRO-TR-71-14 ..... c34 N72-14982 #

IC-AERO-71-18 ..... c01 N72-13979 #
IC-AERO-71-24 ..... c12 N72-14308 #

IDA/HQ-71-12329 ..... c13 N72-14397 #
IDA/HQ-71-12648 ..... c30 N72-14863 #

IFA-SR-32 ..... c20 N72-14645 #

INR-P-1304 ..... c11 N72-14276 #

IPPJ-110 ..... c25 N72-14747 #
IPPJ-111 ..... c25 N72-14746 #
IPPJ-115 ..... c10 N72-14263 #

IPR-10 ..... c17 N72-14563 #
IPR-11 ..... c17 N72-14574 #

IPST-CAT-5980 ..... c18 N72-14586*#

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JA-3733-PT-1-REV ..... c09 N72-14250 #
JA-3800 ..... c26 N72-14765 #

JAERI-MEMO-4437 ..... c25 N72-14748 #

JI-001 ..... c12 N72-14299 #

JOB-1-1304-1 ..... c20 N72-14666 #
JOB-84F02-21-58471 ..... c11 N72-14288 #

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JPL-TM-33-509 ..... c14 N72-14422*#
JPL-TM-33-512 ..... c08 N72-14214*#
JPL-TM-33-514 ..... c10 N72-14262*#
JPL-TM-33-515 ..... c31 N72-14872*#
JPL-TM-33-517 ..... c31 N72-14871*#
JPL-TM-33-519 ..... c29 N72-14808*#
JPL-TM-33-520 ..... c28 N72-14797*#
JPL-TM-33-522 ..... c03 N72-14030*#

JPL-TR-32-1543 ..... c15 N72-14486*#
JPL-TR-32-1544 ..... c15 N72-14485*#

JPL-1030-30 ..... c34 N72-14960*#

JPRS-54704 ..... c30 N72-14834 #
JPRS-54718 ..... c13 N72-14344 #
JPRS-54764 ..... c07 N72-14160 #
JPRS-54768 ..... c05 N72-14066 #
JPRS-54831 ..... c30 N72-14847 #
JPRS-54874 ..... c15 N72-14490 #
JPRS-54875 ..... c15 N72-14489 #
JPRS-54877 ..... c24 N72-14734 #
JPRS-54878 ..... c09 N72-14237 #
JPRS-54879 ..... c18 N72-14594 #
JPRS-54880 ..... c04 N72-14045 #
JPRS-54881 ..... c16 N72-14519 #
JPRS-54975 ..... c07 N72-14172 #
JPRS-54976 ..... c07 N72-14171 #

JUL-711-HA ..... c19 N72-14628 #

KSC-TR-1111 ..... c08 N72-14216*#
KSC-TR-1131 ..... c31 N72-14881*#
KSC-TR-1132 ..... c31 N72-14882*#

L-58 ..... c09 N72-14254 #
L-7985 ..... c31 N72-14877*#
L-7986 ..... c33 N72-14935*#
L-8014 ..... c01 N72-13978*#

LA-DC-12693 ..... c13 N72-14385 #

LA-TR-71-35 ..... c17 N72-14557 #

LCR-DR-1-70-100/1/R ..... c14 N72-14469 #

LMSC/HREC-D225500 ..... c33 N72-14947*#
LMSC/D179854 ..... c16 N72-14526 #

LPTHE-71/47 ..... c24 N72-14735 #
LPTHE-71/50 ..... c10 N72-14264 #

LR-551 ..... c13 N72-14379 #

LWL-CR-02P69 ..... c07 N72-14205 #

MATT-842 ..... c11 N72-14275 #

MCR-71-321 ..... c30 N72-14856*#
MCR-71-326 ..... c04 N72-14044*#

MDC-G2275 ..... c15 N72-14508 #
MDC-G2282 ..... c05 N72-14114*#
MDC-G2683 ..... c31 N72-14896*#

ME-71-T57-12 ..... c15 N72-14512 #

MISC-SSL-71-4 ..... c24 N72-14733*#

MONO-SER-19 ..... c07 N72-14177 #

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MRI-2284-1-VOL-2 ..... c02 N72-14011 #
MRI-2284-1-VOL-3 ..... c02 N72-14019 #
MRI-2284-1-VOL-4 ..... c02 N72-14020 #

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MSC-IN-71-FM-210-VOL-1 ..... c30 N72-14824*#
MSC-IN-71-FM-212 ..... c30 N72-14829*#
MSC-IN-71-FM-216-VOL-2 ..... c30 N72-14826*#
MSC-IN-71-FM-238 ..... c21 N72-14667*#
MSC-IN-71-FM-241 ..... c21 N72-14668*#

MSC-S-261 ..... c09 N72-14234*#

MSC-SM-71-3 ..... c30 N72-14846*#

MSC-T-575 ..... c31 N72-14873*#

MSC-71-FM-219 ..... c30 N72-14825*#
MSC-02474 ..... c31 N72-14873*#
MSC-04348 ..... c30 N72-14827*#
MSC-04354-VOL-2 ..... c30 N72-14825*#
MSC-04369-VOL-1 ..... c30 N72-14824*#
MSC-04369-VOL-2 ..... c30 N72-14826*#
MSC-04373 ..... c30 N72-14829*#
MSC-04440 ..... c21 N72-14667*#
MSC-04445 ..... c21 N72-14668*#

MSFC-DPD-235/DR-SE-06 ..... c31 N72-14896*#

MSL-70-23-VOL-5 ..... c17 N72-14573 #

MTI-71TR39 ..... c15 N72-14501 #

MTP-6-3-025 ..... c07 N72-14188 #
MTP-6-3-208 ..... c21 N72-14677 #
MTP-6-3-209 ..... c21 N72-14678 #
MTP-7-3-120 ..... c09 N72-14247 #
MTP-7-3-523 ..... c11 N72-14272 #
MTP-7-3-524 ..... c07 N72-14189 #
MTP-10-2-505 ..... c05 N72-14125 #
MTP-10-3-061 ..... c27 N72-14785 #

M75-2/2 ..... c13 N72-14364 #
M75-2/3 ..... c13 N72-14365 #
M75-2/5 ..... c13 N72-14336
M75-2/6 ..... c13 N72-14337
M75-2/7 ..... c13 N72-14366 #
M75-2/8 ..... c13 N72-14338
M75-2/9 ..... c13 N72-14339

N-795 ..... c30 N72-14863 #

NADC-MA-7066 ..... c17 N72-14562 #
NADC-MA-7102 ..... c18 N72-14584 #
NADC-MA-7119 ..... c17 N72-14545 #

NAEC-ENG-7649 ..... c11 N72-14288 #

NAL-TR-113 ..... c02 N72-13986*#

NAMRL-1134 ..... c05 N72-14130 #

NASA-CASE-LAR-10103-1 ..... c15 N72-14496*#

NASA-CASE-NPO-11406 ..... c08 N72-14221*#

NASA-CASE-XLA-09843 ..... c15 N72-14497*#

NASA-CR-1825 ..... c14 N72-14425*#
NASA-CR-1835 ..... c05 N72-14114*#
NASA-CR-1844 ..... c02 N72-13991*#
NASA-CR-1859 ..... c18 N72-14585*#
NASA-CR-1861 ..... c33 N72-14938*#
NASA-CR-1877 ..... c11 N72-14274*#
NASA-CR-1896 ..... c33 N72-14933*#
NASA-CR-1912 ..... c01 N72-13977*#
NASA-CR-61365 ..... c01 N72-13976*#
NASA-CR-61368 ..... c15 N72-14483*#
NASA-CR-61369 ..... c31 N72-14870*#
NASA-CR-61370 ..... c20 N72-14641*#
NASA-CR-72752 ..... c14 N72-14420*#
NASA-CR-72844 ..... c15 N72-14498*#
NASA-CR-72948 ..... c23 N72-14696*#
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NASA-CR-72991 ..... c33 N72-14945*#
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NASA-CR-72995 ..... c15 N72-14493*#
NASA-CR-72996 ..... c28 N72-14790*#
NASA-CR-103069 ..... c31 N72-14891*#
NASA-CR-111987 ..... c34 N72-14966*#
NASA-CR-111996 ..... c05 N72-14115*#

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NASA-CR-114389 ..... c28 N72-14799*#
NASA-CR-114390 ..... c28 N72-14800*#
NASA-CR-114393 ..... c05 N72-14113*#
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NASA-CR-114398 ..... c21 N72-14672*#
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NASA-CR-115307 ..... c08 N72-14209*#
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NASA-CR-115324 ..... c08 N72-14211*#
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NASA-CR-125096 ..... c29 N72-14810*#
NASA-CR-125097 ..... c04 N72-14044*#
NASA-CR-125100 ..... c04 N72-14047*#
NASA-CR-125430 ..... c30 N72-14833*#
NASA-CR-125431 ..... c34 N72-14960*#
NASA-CR-126482 ..... c12 N72-14303*#
NASA-NEWS-RELEASE-71-227 ..... c30 N72-14845*#

NASA-NEWS-RELEASE-72-4 ..... c31 N72-14887*#

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NASA-SP-5945(01) ..... c14 N72-14453*#
NASA-SP-5947(01) ..... c09 N72-14233*#
NASA-SP-8078 ..... c07 N72-14169*#

NASA-TM-X-2423 ..... c24 N72-14729*#
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NASA-TM-X-2444 ..... c18 N72-14588*#
NASA-TM-X-2447 ..... c33 N72-14935*#
NASA-TM-X-2452 ..... c06 N72-14147*#
NASA-TM-X-2461 ..... c28 N72-14795*#
NASA-TM-X-2474 ..... c03 N72-14026*#
NASA-TM-X-2478 ..... c28 N72-14791*#
NASA-TM-X-2480 ..... c03 N72-14027*#
NASA-TM-X-2481 ..... c03 N72-14028*#
NASA-TM-X-2482 ..... c17 N72-14550*#
NASA-TM-X-58074 ..... c05 N72-14053*#
NASA-TM-X-58078 ..... c14 N72-14421*#
NASA-TM-X-58079 ..... c30 N72-14828*#
NASA-TM-X-62098 ..... c02 N72-13985*#
NASA-TM-X-64631 ..... c31 N72-14878*#
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NASA-TM-X-67978 ..... c25 N72-14745*#
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NASA-TM-X-67980 ..... c17 N72-14548*#
NASA-TM-X-67981 ..... c33 N72-14937*#
NASA-TM-X-67982 ..... c06 N72-14142*#
NASA-TM-X-67983 ..... c28 N72-14794*#
NASA-TM-X-67984 ..... c17 N72-14549*#
NASA-TM-X-67985 ..... c08 N72-14213*#

NASA-TN-D-6523 ..... c33 N72-14943*#
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NASA-TN-D-6621 ..... c33 N72-14942*#
NASA-TN-D-6627 ..... c01 N72-13978*#
NASA-TN-D-6633 ..... c33 N72-14941*#
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NASA-TN-D-6642 ..... c09 N72-14234*#

NASA-TT-F-658 ..... c12 N72-14304*#
NASA-TT-F-675 ..... c18 N72-14586*#
NASA-TT-F-13833 ..... c14 N72-14464*#
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NASA-TT-F-13840 ..... c14 N72-14456*#
NASA-TT-F-13849 ..... c14 N72-14460*#
NASA-TT-F-13850 ..... c03 N72-14033*#
NASA-TT-F-13851 ..... c09 N72-14235*#
NASA-TT-F-13852 ..... c31 N72-14888*#
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NASA-TT-F-13856 ..... c19 N72-14627*#
NASA-TT-F-13857 ..... c15 N72-14488*#
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NASA-TT-F-13861 ..... c13 N72-14375*#
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NASA-TT-F-13863 ..... c23 N72-14702*#
NASA-TT-F-13864 ..... c06 N72-14148*#
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NASA-TT-F-13866 ..... c31 N72-14890*#
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NASA-TT-F-13868 ..... c30 N72-14851*#
NASA-TT-F-13869 ..... c30 N72-14850*#
NASA-TT-F-13870 ..... c08 N72-14219*#
NASA-TT-F-13871 ..... c07 N72-14175*#
NASA-TT-F-13872 ..... c07 N72-14174*#
NASA-TT-F-13873 ..... c08 N72-14218*#
NASA-TT-F-13874 ..... c08 N72-14217*#
NASA-TT-F-13875 ..... c34 N72-14970*#
NASA-TT-F-13876 ..... c08 N72-14215*#
NASA-TT-F-13877 ..... c23 N72-14701*#
NASA-TT-F-13878 ..... c13 N72-14372*#
NASA-TT-F-13880 ..... c31 N72-14880*#
NASA-TT-F-13881 ..... c18 N72-14591*#
NASA-TT-F-13882 ..... c18 N72-14589*#
NASA-TT-F-13883 ..... c18 N72-14590*#
NASA-TT-F-13884 ..... c30 N72-14843*#
NASA-TT-F-13885 ..... c06 N72-14150*#
NASA-TT-F-13886 ..... c06 N72-14144*#
NASA-TT-F-13887 ..... c30 N72-14844*#
NASA-TT-F-13888 ..... c06 N72-14146*#
NASA-TT-F-13889 ..... c06 N72-14145*#
NASA-TT-F-13890 ..... c13 N72-14367*#
NASA-TT-F-13891 ..... c13 N72-14369*#
NASA-TT-F-13892 ..... c13 N72-14368*#
NASA-TT-F-13893 ..... c13 N72-14370*#
NASA-TT-F-13894 ..... c13 N72-14378*#
NASA-TT-F-13938 ..... c02 N72-13986*#
NASA-TT-F-13950 ..... c03 N72-14023*#
NASA-TT-F-13980 ..... c22 N72-14689*#
NASA-TT-F-14014 ..... c26 N72-14762*#
NASA-TT-F-14038 ..... c17 N72-14552*#
NASA-TT-F-14046 ..... c23 N72-14704*#
NASA-TT-F-14058 ..... c02 N72-13987*#
NASA-TT-F-14059 ..... c02 N72-13993*#
NASA-TT-F-14063 ..... c23 N72-14698*#
NASA-TT-F-14086 ..... c15 N72-14494*#
NASA-TT-F-14091 ..... c23 N72-14700*#

NAVMED-MF 12.524.002-5013D ..... c05 N72-14130 #

NBS-TN-584 ..... c06 N72-14143 #
NBS-TN-593 ..... c09 N72-14232 #

NBS-10562 ..... c21 N72-14679 #
NBS-10605 ..... c26 N72-14768 #

NCL-71-31R-PT-1 ..... c16 N72-14522 #
NCL-71-32R ..... c16 N72-14531 #
NCL-71-41R ..... c16 N72-14521 #

NEDU-RR-7-71 ..... c05 N72-14126 #

NLCO-1064 ..... c17 N72-14554 #

NLL-II7H8075/B c13 N72-14335

NLL-M-20751-(5828.4F) c13 N72-14335

NLL-RISLEY-TR-2038-(9091.9F) c22 N72-14688

NLL-SMRE-TRANS-5902-(8313.4) c15 N72-14482

NLL-746-900-(9022.401) c17 N72-14537
NLL-746-992-(9022.401) c17 N72-14536
NLL-746-1059-(9022.401) c17 N72-14539
NLL-746-1061-(9022.401) c17 N72-14538

NOAA-TM-NWS-SR-53 ..... c20 N72-14638 #
NOAA-TM-NWS-SR-54 ..... c20 N72-14639 #
NOAA-TM-NWS-SR-56 ..... c20 N72-14640 #

NOLTR-71-91 ..... c12 N72-14323 #
NOLTR-71-95 ..... c30 N72-14861 #
NOLTR-71-123 ..... c12 N72-14312 #
NOLTR-71-128 ..... c15 N72-14507 #
NOLTR-71-134 ..... c11 N72-14281 #

NORT-70-353-4 ..... c07 N72-14181 #

NP-18912 ..... c25 N72-14750 #
NP-18913 ..... c25 N72-14749 #
NP-18922 ..... c09 N72-14240 #

NPL-71-24 ..... c12 N72-14308 #

NR-70H-570 ..... c02 N72-14002 #

NRC-12318 ..... c13 N72-14379 #

NRL-MR-2300 ..... c17 N72-14563 #
NRL-MR-2303 ..... c14 N72-14473 #
NRL-MR-2318 ..... c25 N72-14752 #
NRL-MR-2333 ..... c17 N72-14574 #
NRL-MR-2334 ..... c09 N72-14251 #

NRL-PROBL-F01-03A ..... c17 N72-14566 #

NRL-PROBL-M04-02 ..... c17 N72-14574 #

NRL-PROBL-R07-14 ..... c33 N72-14954 #

NRL-R02-33 ..... c09 N72-14251 #

NRL-7283 ..... c17 N72-14566 #
NRL-7291 ..... c23 N72-14718 #
NRL-7299 ..... c17 N72-14565 #
NRL-7305 ..... c12 N72-14317 #
NRL-7313 ..... c17 N72-14577 #
NRL-7314 ..... c33 N72-14954 #
NRL-7339 ..... c09 N72-14249 #

NSF-72-106 ..... c34 N72-14978 #

NSRDC-3635 ..... c12 N72-14311 #
NSRDC-3677 ..... c12 N72-14320 #

NSTIC-TRANS-2451 ..... c20 N72-14656 #

NSTIC-30610 ..... c20 N72-14656 #

NTSB-AAR-71-15 ..... c02 N72-13990 #

NUSC-4097 ..... c13 N72-14417 #

NVO-1163-233 ..... c13 N72-14387 #

NWC-TP-5192 ..... c16 N72-14530 #

NWEF-1081 ..... c24 N72-14741 #

NWER-SUBTASK-SB209 ..... c13 N72-14409 #

NYU-AA-70-12 ..... c12 N72-14327 #
NYU-AA-70-28 ..... c12 N72-14303*#

ONERA-TP-983 ..... c23 N72-14700*#

ONR-CODE-461 ..... c12 N72-14333 #
ONR-CODE-461 ..... c12 N72-14334 #

ONRL-C-6-71 ..... c07 N72-14197 #
ONRL-C-16-71 ..... c26 N72-14767 #

ONRL-R-36-71 ..... c23 N72-14712 #

ORNL-NSIC-85 ..... c24 N72-14738 #

ORNL-RSIC-32 ..... c22 N72-14691 #

ORNL-TM-3315 ..... c23 N72-14707 #

OSD-1366 ..... c03 N72-14037 #
OSD-1366 ..... c09 N72-14246 #
OSD-1366 ..... c20 N72-14665 #

P-756 ..... c13 N72-14397 #

PA-TM-2016 ..... c17 N72-14575 #

PA-TR-4215 ..... c18 N72-14612 #

PAPER-3 ..... c23 N72-14722 #

PB-200869 ..... c18 N72-14596 #

PD-MP-P ..... c31 N72-14883*#

PHO-TN514 ..... c08 N72-14211*#
PHO-TN515 ..... c08 N72-14212*#

PIA-TASK-T66-01-8 ..... c15 N72-14503 #

PIBAL-71-18 ..... c12 N72-14319 #

PIFR-174 ..... c17 N72-14564 #

PR-4 ..... c07 N72-14181 #

PROGRAM-CODE-9E20 ..... c16 N72-14533 #
PROGRAM-CODE-42 ..... c16 N72-14526 #

PROGRAM-ELEMENT-63311F ..... c14 N72-14479 #
PROGRAM-ELEMENT-65802F ..... c33 N72-14957 #
PROGRAM-ELEMENT-62405334 ..... c25 N72-14757 #

PUBL-132 ..... c32 N72-14911 #
PUBL-133 ..... c32 N72-14912 #
PUBL-888 ..... c13 N72-14384*#

PWA-4210 ..... c03 N72-14040 #
PWA-4276 ..... c12 N72-14321 #

QE/C-71-187 ..... c03 N72-14035*#

QEEL-TR-12 ..... c20 N72-14666 #

QPR-5 ..... c07 N72-14200 #

QR-1 ..... c31 N72-14889*#
QR-2 ..... c14 N72-14457*#
QR-2 ..... c32 N72-14907*#

QUEEL/C-71-366 ..... c03 N72-14024*#

R-123U ..... c08 N72-14222 #
R-519 ..... c10 N72-14268 #
R-520 ..... c34 N72-14980 #
R-597-PR ..... c14 N72-14476 #
R-668-PR ..... c30 N72-14865 #
R-678-VOL-1 ..... c21 N72-14669*#
R-678-VOL-2 ..... c21 N72-14670*#
R-678-VOL-3 ..... c21 N72-14671*#
R-678-VOL-4-PT-2 ..... c21 N72-14672*#
R-682-PR ..... c12 N72-14318 #
R-707-PR ..... c07 N72-14193 #
R-722-PR ..... c07 N72-14192 #
R-771-PR ..... c07 N72-14194 #

RADC-TR-71-109 ..... c26 N72-14771 #
RADC-TR-71-141 ..... c07 N72-14185 #
RADC-TR-71-143 ..... c07 N72-14184 #
RADC-TR-71-147 ..... c14 N72-14474 #
RADC-TR-71-163 ..... c07 N72-14204 #
RADC-TR-71-166 ..... c09 N72-14253 #
RADC-TR-71-168 ..... c07 N72-14186 #
RADC-TR-71-172 ..... c07 N72-14179 #

RAE-LIB-TRANS-1571 ..... c14 N72-14463 #
RAE-LIB-TRANS-1584 ..... c32 N72-14910 #
RAE-LIB-TRANS-1600 ..... c28 N72-14801 #

RAE-TR-70053 ..... c33 N72-14951 #
RAE-TR-70137 ..... c30 N72-14859 #
RAE-TR-70159 ..... c18 N72-14595 #
RAE-TR-71068 ..... c31 N72-14897 #
RAE-TR-71075 ..... c31 N72-14898 #
RAE-TR-71089 ..... c31 N72-14899 #
RAE-TR-71091 ..... c11 N72-14278 #

RD-TR-71-14 ..... c08 N72-14231 #
RD-TR-71-15 ..... c08 N72-14229 #
RD-TR-71-17 ..... c33 N72-14959 #

RE-TR-71-4 ..... c07 N72-14206 #

REPT-1 ..... c26 N72-14766 #
REPT-1-0003 ..... c18 N72-14602 #
REPT-2 ..... c09 N72-14246 #
REPT-2 ..... c09 N72-14252 #
REPT-2-71 ..... c14 N72-14468 #
REPT-3 ..... c03 N72-14034*#
REPT-3SR-795 ..... c20 N72-14658 #
REPT-3WW-TN-71-2 ..... c20 N72-14657 #
REPT-5 ..... c13 N72-14409 #
REPT-5WWTN-71-5 ..... c20 N72-14661 #
REPT-06B891 ..... c26 N72-14770 #
REPT-22-4081-2 ..... c09 N72-14252 #
REPT-22-4083-2 ..... c09 N72-14246 #
REPT-69-11-VOL-2 ..... c01 N72-13977*#
REPT-70-6785 ..... c28 N72-14802 #
REPT-70/CT/TA/EB/0.671/EOLE/B ..... c03 N72-14032*#
REPT-70/CT/TA/EB/0.672/EOLE/B ..... c03 N72-14031*#

REPT-71-2 ..... c01 N72-13980 #
REPT-71-5 ..... c12 N72-14309 #
REPT-71/CT/TA/EB/EOLE-B/O.809 ..... c03 N72-14025*#
REPT-71/893/CT/TE/EG/EOLE/B ..... c14 N72-14460*#
REPT-100 ..... c26 N72-14772 #
REPT-140 ..... c32 N72-14926 #
REPT-368-35 ..... c28 N72-14803 #
REPT-418 ..... c23 N72-14698*#
REPT-567/CB/ES/E ..... c07 N72-14173*#
REPT-584-4-708 ..... c31 N72-14889*#
REPT-611-2F ..... c17 N72-14578 #
REPT-4423 ..... c23 N72-14710 #
REPT-5012(BTN)R1 ..... c16 N72-14535 #
REPT-6479 ..... c09 N72-14238 #
REPT-7042-VOL-1 ..... c34 N72-14973 #
REPT-7042-VOL-2 ..... c34 N72-14974 #
REPT-7042-VOL-3 ..... c34 N72-14975 #
REPT-7042-VOL-4 ..... c34 N72-14976 #
REPT-7042-VOL-5 ..... c34 N72-14977 #
REPT-11218-F ..... c15 N72-14493*#
REPT-61102F ..... c12 N72-14327 #
REPT-61102F ..... c12 N72-14332 #
REPT-61102F ..... c16 N72-14535 #
REPT-61102F ..... c27 N72-14787 #
REPT-62301D ..... c30 N72-14862 #
REPT-037250-2 ..... c26 N72-14771 #
REPT-681301 ..... c16 N72-14535 #
REPT-681302 ..... c24 N72-14740 #
REPT-681307 ..... c12 N72-14327 #
REPT-681307 ..... c12 N72-14332 #
REPT-681307 ..... c17 N72-14578 #
REPT-681308 ..... c27 N72-14787 #
REPT-6144501 ..... c24 N72-14740 #

REPT70.CT.TA.TP/METEOSAT-0-492 .... c14 N72-14464*#

RL-TR-71-6 ..... c27 N72-14788 #
RL-TR-71-7 ..... c18 N72-14611 #

RM-526 ..... c26 N72-14761 #
RM-528J ..... c13 N72-14373 #
RM-529J ..... c24 N72-14730 #
RM-530 ..... c19 N72-14624 #
RM-531J ..... c24 N72-14732 #
RM-532J ..... c14 N72-14458 #

RPE-TR-71/2 ..... c33 N72-14956 #

RR-TR-71-3 ..... c26 N72-14780 #

RR-82/GCA-1 ..... c19 N72-14618 #

RUAL-9 ..... c07 N72-14185 #
RUAL-16 ..... c07 N72-14184 #

R71-29 ..... c32 N72-14926 #

S-DOC-92-40 ..... c34 N72-14961 #
S-DOC-92-51 ..... c34 N72-14967 #

S-0250 ..... c31 N72-14876*#
S-1042 ..... c31 N72-14874*#

SACLANTCEN-TM-168 ..... c13 N72-14414 #
SACLANTCEN-TM-170 ..... c07 N72-14203 #

SAM-TT-R-1103-0971 ..... c26 N72-14775 #
SAM-TT-R-1110-0971 ..... c05 N72-14135 #

SAMSO-TR-71-126 ..... c21 N72-14676 #
SAMSO-TR-71-163 ..... c21 N72-14681 #
SAMSO-TR-71-167 ..... c12 N72-14325 #
SAMSO-TR-71-168 ..... c16 N72-14528 #
SAMSO-TR-71-186 ..... c17 N72-14570 #
SAMSO-TR-71-192 ..... c25 N72-14755 #
SAMSO-TR-71-210 ..... c07 N72-14191 #

SAO-111-098 ..... c24 N72-14727*#

SAPE-10 ..... c09 N72-14236*#

SAR-1 ..... c06 N72-14151 #
SAR-2 ..... c30 N72-14862 #
SAR-3 ..... c21 N72-14674 #
SAR-10 ..... c03 N72-14038 #
SAR-17 ..... c30 N72-14849*#

SASR-4 ..... c23 N72-14714 #
SASR-17 ..... c29 N72-14809*#

SATR-2 ..... c26 N72-14774 #
SATR-2 ..... c30 N72-14833*#

SC-DC-713697 ..... c09 N72-14239 #
SC-DC-713903 ..... c23 N72-14706 #
SC-DC-714022 ..... c02 N72-13994 #

SC-DR-710423 ..... c10 N72-14265 #

SC-RR-71-0742 ..... c04 N72-14043*#

SCIENTIFIC-54 ..... c07 N72-14201 #
SCIENTIFIC-55 ..... c07 N72-14202 #

SCL-RR-710056 ..... c33 N72-14950 #

SD-70-375-1 ..... c30 N72-14854*#
SD-70-375-2-APP-A ..... c30 N72-14853*#
SD-71-221 ..... c31 N72-14873*#
SD-71-487 ..... c30 N72-14852*#

SER-50697 ..... c02 N72-14001 #

SIO-REF-71-1 ..... c23 N72-14725 #

SP-71-01 ..... c15 N72-14506 #

SPR-044 ..... c03 N72-14022*#

SR-1 ..... c07 N72-14195 #
SR-1 ..... c20 N72-14649 #
SR-7 ..... c26 N72-14778 #
SR-13 ..... c07 N72-14199 #
SR-15 ..... c13 N72-14391 #
SR-54 ..... c07 N72-14201 #
SR-55 ..... c07 N72-14202 #

SRCC-160 ..... c06 N72-14141*#

SRDE-70044 ..... c14 N72-14480 #

STI-TR-194-1 ..... c02 N72-14007 #

SU-ML-1973 ..... c23 N72-14714 #

SU-SASR-120 ..... c23 N72-14717 #

SU-SEL-71-029 ..... c23 N72-14717 #

SUBTASK-AA106 ..... c17 N72-14573 #

SUBTASK-TA040 ..... c23 N72-14716 #

SUBTASK-35 ..... c09 N72-14254 #
SUBTASK-312 ..... c03 N72-14039 #

SUDAAR-422 ..... c21 N72-14686 #

SWRI-RS-572 ..... c15 N72-14502 #

S026 ..... c30 N72-14842*#

TASC-TR-192-2-VOL-1 ..... c21 N72-14687 #

TASK-AM-A-71-PSY-27 ..... c05 N72-14116 #

TASK-A320-5203/202-B/1 ..... c17 N72-14562 #

TASK-IG162204A01409 ..... c15 N72-14514 #

TASK-SF-11-141-005-13628 ..... c09 N72-14251 #
TASK-SF-11-522-101-12858 ..... c13 N72-14417 #
TASK-SF-354-21-003 ..... c12 N72-14320 #

TASK-T-68 ..... c30 N72-14863 #

TASK-ZR-011-01-01-61101N ..... c13 N72-14417 #

TASK-ZR011-01-01 ..... c16 N72-14530 #

TASK-1-T-061102-B-53-A-17 ..... c20 N72-14665 #
TASK-1F162204-A-14235 ..... c02 N72-14017 #
TASK-1F162204-A-14235 ..... c02 N72-14018 #
TASK-1F162204AA4405 ..... c02 N72-14001 #
TASK-01 ..... c09 N72-14254 #
TASK-02 ..... c03 N72-14039 #
TASK-01710 ..... c12 N72-14320 #
TASK-12361 ..... c07 N72-14190 #

TASK-30120-9 ..... c28 N72-14804 #
TASK-30120-9 ..... c28 N72-14805 #
TASK-56008 ..... c16 N72-14535 #
TASK-61102F ..... c21 N72-14684 #
TASK-112103 ..... c05 N72-14129 #
TASK-304806 ..... c15 N72-14502 #
TASK-314522 ..... c03 N72-14042 #
TASK-510215 ..... c21 N72-14686 #
TASK-557303 ..... c07 N72-14204 #
TASK-563506 ..... c07 N72-14199 #
TASK-606503 ..... c02 N72-14000 #
TASK-681304 ..... c21 N72-14684 #
TASK-718409 ..... c04 N72-14052 #
TASK-723104 ..... c09 N72-14256 #
TASK-723305 ..... c08 N72-14228 #
TASK-735003 ..... c26 N72-14779 #
TASK-735106 ..... c32 N72-14925 #
TASK-821905 ..... c02 N72-14008 #
TASK-895102 ..... c12 N72-14322 #

TE-48 ..... c02 N72-13984*#

TECH-PAPER-21 ..... c20 N72-14644 #

THEMIS-UI-33 ..... c17 N72-14559 #
THEMIS-UI-34 ..... c17 N72-14558 #
THEMIS-UI-36 ..... c32 N72-14915 #
THEMIS-UI-37 ..... c11 N72-14284 #

THEMIS-603 ..... c05 N72-14139 #

TM-71-70 ..... c32 N72-14927 #
TM-71-1011-7 ..... c20 N72-14642*#
TM-71-2014-6 ..... c30 N72-14840*#
TM-71-2015-6 ..... c14 N72-14455*#
TM-71-2015-7 ..... c30 N72-14837*#
TM-71-2015-9 ..... c30 N72-14839*#
TM-71-2015-10 ..... c14 N72-14454*#
TM-71-2031-2 ..... c33 N72-14939*#

TN-AP-71-527 ..... c01 N72-13976*#

TN-KE2-59/70 ..... c07 N72-14170 #

TOR-0059(S6860)-2 ..... c07 N72-14191 #

TR-1 ..... c12 N72-14315 #
TR-1 ..... c18 N72-14602 #
TR-1 ..... c19 N72-14619*#
TR-1-71 ..... c17 N72-14582 #
TR-1-71 ..... c23 N72-14724 #
TR-2 ..... c08 N72-14209*#
TR-2 ..... c12 N72-14314 #
TR-2 ..... c17 N72-14576 #
TR-3 ..... c12 N72-14316 #
TR-4 ..... c12 N72-14334 #
TR-5 ..... c12 N72-14333 #
TR-5 ..... c26 N72-14769 #
TR-6 ..... c12 N72-14330 #
TR-6 ..... c17 N72-14581 #
TR-8 ..... c03 N72-14041 #
TR-8 ..... c23 N72-14711 #
TR-8 ..... c24 N72-14739 #
TR-9 ..... c23 N72-14713 #
TR-17 ..... c32 N72-14919 #
TR-18 ..... c18 N72-14601 #
TR-41 ..... c10 N72-14266 #
TR-43 ..... c21 N72-14681 #
TR-46 ..... c10 N72-14270 #
TR-71-25 ..... c05 N72-14118 #
TR-71-35 ..... c32 N72-14908 #
TR-71-37 ..... c15 N72-14491 #
TR-71-43 ..... c15 N72-14492 #
TR-206 ..... c09 N72-14245 #
TR-0059(6472)-7 ..... c21 N72-14676 #
TR-0172(2220-60)-1 ..... c25 N72-14755 #
TR-0172(2250-10)-1 ..... c17 N72-14570 #
TR-0172(9210-02)-1 ..... c16 N72-14528 #

TRC-BR-19341 ..... c33 N72-14951 #
TRC-BR-25649 ..... c14 N72-14480 #
TRC-BR-25664 ..... c33 N72-14956 #

TRITA-EPP-71-18 ..... c25 N72-14751 #

TSR-14 ..... c23 N72-14710 #

TT-68-50638 ..... c13 N72-14371 #
TT-70-50187 ..... c12 N72-14304*#
TT-70-57236 ..... c13 N72-14371 #
TT-71-50050 ..... c18 N72-14586*#

T702301-2301 ..... c10 N72-14267 #
T702301-2301 ..... c02 N72-13999 #
T702301-2301 ..... c16 N72-14523 #
T702301-2301 ..... c17 N72-14571 #
T702301-2301 ..... c18 N72-14598 #
T702301-2301 ..... c18 N72-14604 #
T702301-2301 ..... c19 N72-14629 #
T702301-2301 ..... c19 N72-14631 #
T702301-2301 ..... c21 N72-14682 #

U-OF-IOWA-71-27 ..... c29 N72-14811 #

UARL-K910828-31 ..... c01 N72-13982 #

UC-MET-6-71 ..... c17 N72-14578 #

UCLA-ENG-7128 ..... c08 N72-14226 #
UCLA-ENG-7130 ..... c07 N72-14198 #
UCLA-ENG-7133 ..... c21 N72-14684 #
UCLA-ENG-7136 ..... c10 N72-14269 #
UCLA-ENG-7153 ..... c17 N72-14581 #

UCRL-72877 ..... c22 N72-14690 #

UDC.621.314.5 ..... c33 N72-14951 #

UDC-521.6 ..... c30 N72-14859 #
UDC-521.312.4 ..... c30 N72-14859 #
UDC-531.112.2 ..... c30 N72-14859 #
UDC-536.33 ..... c33 N72-14951 #
UDC-536.75 ..... c24 N72-14734 #
UDC-541.127 ..... c33 N72-14956 #
UDC-542.91 ..... c18 N72-14594 #
UDC-550.388.2 ..... c07 N72-14171 #
UDC-550.388.2 ..... c07 N72-14172 #
UDC-551.510 ..... c29 N72-14357 #
UDC-551.510 ..... c13 N72-14358 #
UDC-551.510 ..... c29 N72-14359 #
UDC-551.510.53 ..... c20 N72-14360 #
UDC-551.510.53 ..... c30 N72-14859 #
UDC-551.510.535 ..... c29 N72-14347 #
UDC-551.510.535 ..... c29 N72-14348 #
UDC-551.510.535 ..... c29 N72-14349 #
UDC-551.510.535 ..... c13 N72-14352 #
UDC-551.510.535 ..... c13 N72-14354 #
UDC-551.510.535 ..... c29 N72-14356 #
UDC-551.510.535+523.745 ..... c13 N72-14344 #
UDC-551.510.535+523.745 ..... c29 N72-14353 #
UDC-551.510.535+537.56 ..... c29 N72-14350 #
UDC-551.510.535+537.56 ..... c13 N72-14351 #
UDC-551.510.535;551.508 ..... c31 N72-14346 #
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